Heat Networks market study: final report

Appendices

Appendix A: Heat network prices

CMA sample of heat networks

1. The main source of information on the population of heat networks was a database of communal and district heat networks notified to BEIS in compliance with the Heat Networks (Metering and Billing) Regulations 2014. In principle, the database should include most heat networks that supply and charge for heating/hot water in the UK.[1]

2. The CMA obtained a copy of this database from BEIS in response to a formal information request under section 174 of the Enterprise Act 2002 (the Act). The database contained information on around 11,000 heat networks, operated by around 1,600 heat suppliers, that supply heating and/or hot water to residential dwellings.

3. It was important to collect data on a sufficiently large number of heat networks that were broadly representative of the wider population (as proxied by the BEIS database). This was to allow for a robust pricing analysis from which inferences could be drawn on the wider population. At the same time, the exercise needed to be manageable in terms of the resources required to identify the correct contact within each organisation and to deal with queries.

4. We randomly selected 100 heat suppliers from the BEIS database. To ensure UK coverage, we added two additional heat suppliers in Northern Ireland. Following further investigation, we did not send questionnaires where: the heat network or building had been removed post-notification; the original notification had been made in error; the heat supplier only supplied cooling; or we could not identify an appropriate contact to send the questionnaire to. During the market study we found that a small number of organisations that received questionnaires could not respond because they were either not in scope[2] or had been incorrectly identified as the heat network operator. We therefore sent questionnaires to 82 relevant heat suppliers (or their representatives). We received responses from 68 suppliers, who provided

[1] The database does not, however, cover some of the very smallest heat networks, see Heat Networks Consumer Survey: Technical report, BEIS, 2017, footnote 19.
[2] For instance, because the heat network only supplied communal areas or the dwellings were not in scope of the Heat Networks (Metering and Billing) Regulations 2014 (for instance because some living facilities, such as cooking, were shared).

information on 445 heat networks that, together, supply heating/hot water to over 22,000 dwellings ('our sample').[3]

5. Because we requested information from a random selection of heat suppliers, and because not all the suppliers contacted provided the requested information,[4] we assessed how closely the characteristics of our sample matched those of the networks contained in the BEIS database.[5] We compared features including: their location; the proportion using each type of fuel and technology; and size (measured by dwellings and heat supplied). We found that the features of our sample were broadly in line with those of the BEIS database. An exception was that our sample included a substantially lower proportion of networks that supply relatively few dwellings.[6]

6. We considered whether differences between the characteristics of our sample and the BEIS database were likely to impact our analysis of prices. However, taking into account both the extent of under-sampling and how much customers on smaller networks tend to pay for heat, we anticipate that the overall effects of under-sampling on our analysis are likely to be relatively small.

7. To maximise the number of heat networks on which we obtained information, we sampled on the basis of heat suppliers and requested details on all or most of their heat networks.[7] Consequently, the largest 11 heat suppliers

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[3] Since publication of the Update Paper, the CMA received updated information from one heat supplier. This included revised data on the amount it charged residents for heat on each of its heat networks. The heat supplier also submitted data on heat charges and/or heat generated for 10 heat networks where it had not previously submitted any such information. Consequently, while the total sample size is unchanged at 445 heat networks, the number of networks included in some parts of the subsequent analysis has increased.
[4] In addition to those heat suppliers that did not respond to our information request, two representatives of heat suppliers provided information on different heat networks to those that had been requested. We also requested information on only a subset of some heat suppliers' networks (see footnote 6).
[5] BEIS have identified data quality issues with some records contained in this database and recently published statistics following a data cleaning exercise. See Experimental statistics on heat networks, BEIS, 2018. We note that the features of our sample appear to remain broadly in line with the results published from this cleaned dataset, including with regard to: the proportion of residential dwellings that are metered; the proportion of networks powered by natural gas; and the proportion that are district (as opposed to communal) networks.
[6] For instance, 25% of networks in our sample supplied 20 dwellings or less compared to 42% of networks that supply residential dwellings in the BEIS database.
[7] To limit the burden on three heat suppliers operating large numbers of heat networks, the information request was limited to a maximum of 50 heat networks per heat supplier. In a further instance, the CMA agreed to reduce the number of networks on which information was required where the supplier provided sufficient explanation that they could not provide information on all their heat networks within the required timeframe. In all but one instance, where a supplier provided information on a subsample of their networks, the CMA randomly selected those networks that information was provided on.

account for 16% of those heat suppliers who responded, but 76% of heat networks in our sample. We found some evidence of homogeneity within the heat networks operated by some large heat suppliers. For instance, some heat suppliers charge a comparable price per unit for heat across each of their networks. This effectively reduces the number of independent pricing observations in our sample and may limit our ability to draw inferences on prices from the sample to the wider population.

8. Taking into account the above factors, we consider that our sample is likely to be broadly representative of the wider population of heat networks. It is nevertheless appropriate to limit inferences from the sample analysis to the wider population to results that are substantial and supported by other evidence.

Information requested from suppliers

9. We requested a range of information from heat suppliers on their heat supply and heat charges in 2016,[8] and the characteristics of their heat networks and the dwellings they supply.[9]

10. We focused on obtaining network-level information that would allow us to calculate what customers pay on average for heat on a given heat network. This allowed us to assess whether customers on some heat networks systematically pay more compared to the likely cost of individual gas boiler heating, and to compare what customers pay on different types of heat network.

11. Almost all respondents were able to provide information on the total heat supplied[10] but only around one-fifth provided precise, measured data. Of the remainder, many could not provide accurate information because the network did not have dwelling-level heat meters. Around a quarter of respondents provided an estimate of heat supplied. We understand that this usually

[8] Or financial year 2016/17 if this was more readily available. Three heat suppliers provided data relating to a different time period: two of these because they recorded data for a different time period; and another that provided information for 2017/18.
[9] We also requested information on the incidence of interruptions and customer disconnection options, which are discussed in paragraphs 3.41–3.42 and footnote 80 respectively of the Update paper. Heat suppliers were also asked to provide information on aspects of the heat network funded by grants and subsidies, and the contract length for end customers – results from these questions are not reported as the response rates were very low.
[10] Two respondents did not provide this information. In one instance the CMA was able to use the heat supplied data that had previously been submitted to BEIS for that heat network.

involved the respondent following guidance published by BEIS on typical heat losses from boilers or typical heat consumption of dwellings.[11]

12. Around half of respondents only provided data on either the amount of fuel used or the heat generated by the boiler.[12] In these cases the CMA adjusted the figure provided to obtain an estimate of heat supplied. This required making assumptions about the efficiency of the boiler and/or the amount of heat lost from the distribution network (ie between the boiler and the dwellings) including:

(a) Where a respondent provided us with data on the amount of fuel used by a boiler,[13] we estimated the amount of heat generated using BEIS published statistics on typical boiler efficiencies.[14]

(b) Where we had a heat generated figure, we calculated the heat supplied to dwellings by estimating distribution losses in one of two ways:

i. If the heat network had previously been notified to BEIS, and data provided on heat generated and heat supplied, we used these two figures to estimate the implied distribution losses;[15]

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[11] See Heat Estimator Tool, BEIS, 2016 and Heat Network (Metering and Billing) Regulations 2014: Guidance for Estimating Heat Capacity/Generated/Supplied, BEIS, 2016. One respondent estimated the total heat supplied for 2016 by extrapolating a single month's observation. The CMA considered that this was unlikely to be a reliable estimate so used the figure that had previously been submitted to BEIS for that heat network.

[12] This included 19 heat networks operated by five heat suppliers who did not confirm what the information they had provided related to. In these cases we assumed that the information related to fuel usage.

[13] That is, the energy content of fuel used (kWh). We acknowledge that, in a small number of instances, heat suppliers could have submitted data on fuel volume rather than fuel energy. This would have affected the subsequent calculation of prices/charges for heat on those networks. However, the number of instances where this could potentially have occurred is small and appears more likely to have resulted in some prices per unit of heat being overestimated rather than underestimated.

[14] See Heat Network (Metering and Billing) Regulations 2014: Guidance for Estimating Heat Capacity/Generated/ Supplied, BEIS, 2016. On a cautious basis, for networks run using an oil boiler, we assumed the boiler efficiency associated with older models. In a further five instances it was not clear what boiler efficiency to assume: two networks had a combined heat and power (CHP) plant, two were operated at least partly by a heat pump and one network did not state the boiler type. In these instances we used the same assumptions as for a natural gas boiler.

[15] We did this for 248 heat networks operated by 24 heat suppliers. The range of implied distribution losses varied from a minimum of 1% to a maximum of 58%, with an interquartile range of between 11% and 30% and a median value of 20%.

ii. If there was no previous BEIS notification data,[16] we assumed that the network suffered distribution losses of 22.2%, which was the aggregate distribution loss across heat networks notified to BEIS.[17]

13. There are a very wide range of possible values for boiler efficiencies and distribution losses. It is therefore not clear that the benchmarks we (or third parties) have used are correct for each individual heat network.

14. As a cross check, for a sub-sample of heat networks in our sample, we compared the heat supplied figures provided to (or estimated by) the CMA to apparently equivalent data previously submitted to BEIS.[18] We found some substantial differences: there was a 20% or greater difference in the implied heat supplied per dwelling for 65% of the heat networks. We did not, however, find evidence to suggest that the heat supplied data used in our sample analysis was systematically higher (and prices per unit lower) on average.

15. Providing information on total charges was also challenging for some respondents. We requested information on all charges related to the operation, maintenance and administration of the network. Many respondents had to disaggregate heat charges from wider service charges or rent payments. We acknowledge that some respondents could have calculated these total charges inaccurately (and/or excluded some relevant costs).

16. For example, two heat suppliers provided information on only the costs of operating the heat network (as opposed to the charges paid by customers), because it was difficult to attribute charges to heating/hot water. In one instance this was because the heat supplier included heating/hot water within rent payments. In the other instance, the heat supplier provided an employee with free accommodation. In these cases, we considered that the costs of the network were a suitable basis for estimating the charges that customers on these networks effectively faced (for example, via higher rent or lower earnings) although we acknowledge that this approach could also potentially understate charges.

17. Notwithstanding these issues, we consider that most heat suppliers are likely to have a relatively good knowledge of the major costs and charges associated with their heat networks.

[16] Which was the case for 59 heat networks operated by 15 heat suppliers.
[17] Total heating/hot water supplied 10,075 GWh versus generation of 12,952 GWh. See Experimental statistics on heat networks, table 5, BEIS, 2018.
[18] We matched 254 heat networks within our sample to the corresponding BEIS notification based on a comparison of postcode.

18. Considering the issues that respondents experienced in providing data, caution should be exercised in interpreting data on individual networks. This is particularly the case with regard to data on heat supplied or metrics based on this, such as price per unit. Analysis of the overall sample (for example, calculations of average/median prices) should be less prone to impact from individual errors, but should still be interpreted alongside a range of other evidence.

The characteristics of our sample

19. The main characteristics of our sample include:

(a) Dwellings are predominantly (94%) flats and have two or fewer bedrooms (86%);

(b) The heat networks were predominantly built since the 1950s, with 23% built in the last 10 years and 32% since 2000;

(c) 79% are communal schemes (accounting for 56% of dwellings); 21% of heat networks are district networks but, as they tend to be larger, they supply 44% of all dwellings;

(d) The heat networks are almost all run using boilers (99%) and natural gas (94%);

(e) Only 13% of networks and 27% of dwellings are metered, where individual heat charges directly relate to individual heat consumption;

(f) The smallest heat network supplies two dwellings, and the largest over 1,500 dwellings. The majority are relatively small, with a median of 31 dwellings and three-quarters supplying fewer than 45 dwellings;

20. Most (65%) of the heat suppliers in our sample are private operators, but they account for only 12% of networks. About two-thirds of networks in our sample are operated by non-profit organisations, such as housing associations and charities. This is shown in the table below.[19]

[19] We asked respondents for information on what type of organisation established, owned, and operated each heat network. These categories were interpreted differently by respondents. To ensure a consistent methodology we sometimes reclassified heat networks. For example, we categorised the operator as a private organisation if a property management company responded to the questionnaire and we categorised the owner as private if it appeared to be a resident association.

Table 1: Sample, by type of operator[20]

	Non-profit[21]	Local Authority	Private[22]	% Total
Suppliers	27%	10%	63%	100
Networks	65%	23%	12%	100
Dwellings	44%	24%	31%	100

Source: CMA Supplier Questionnaire.

21. We asked heat suppliers how their charges for heating/hot water were set. Most heat suppliers stated that they set charges based on the (actual or expected) costs of operating the network. Most heat networks operated by a local authority or non-profit organisation in our sample appear to set prices in this way. Notably, prices for around a quarter of privately operated heat networks are set according to some comparison to the costs of other heat sources. Furthermore, whereas a high proportion of non-profit and local authority networks set charges by recovering costs incurred in the previous year, a relatively higher proportion of private operators set charges based on expected costs for the coming year:

Table 2: Price setting approach, by operator type

	Local Authority	Non-profit	Private (%)
Costs of operating the network			
Last year's costs plus inflation	49%	47%	15%
Expected future costs	10%	13%	23%
Pass-through of ongoing costs	0%	11%	10%
Comparison to other heat sources	0%	0%	23%
Combination of approaches	0%	3%	0%
Other[23]	41%	12%	17%
No response	1%	15%	12%
Total	100	100	100

Source: CMA Supplier Questionnaire.

[20] We used operator rather than owner as we considered that the categorisation was likely to be slightly more accurate. In all but a very small number of networks (six) we judged that the operator and owner of the heat network were the same type of organisation. The conclusions of analysis based on type of operator are therefore very similar if assessed on the basis of type of owner.
[21] Defined as including: housing associations; registered charities; social housing providers; almshouses.
[22] Defined as including: privately owned estates; resident associations; property management companies.
[23] "Other" includes both respondents who reported a price-setting method which did not clearly belong to any of the other categories, and respondents who, for example, explained why charges would differ between households, but not how overall charges were set.

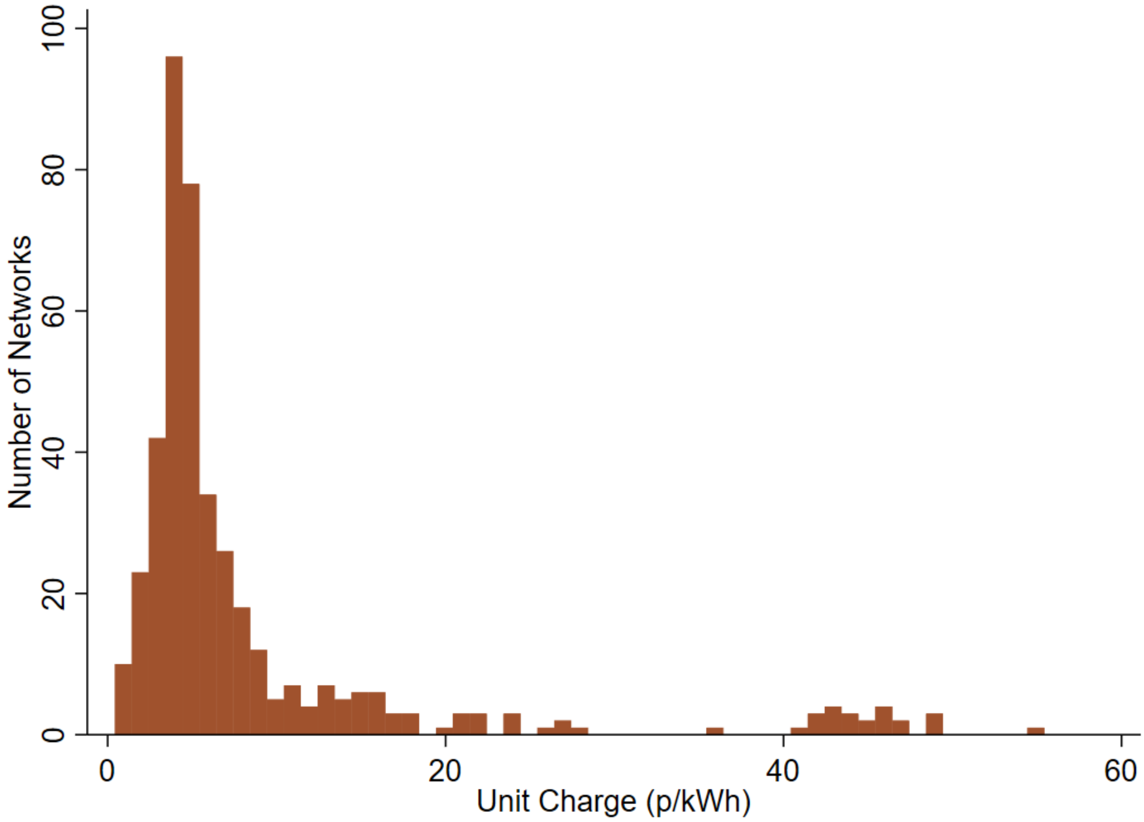
What do customers on heat networks pay for heating/hot water?

22. We calculated the price per unit of heat on each network by taking the total sum of all charges (related to the operation, maintenance and administration of the heat network) for heat to residential dwellings on that network[24] and dividing through by the total heat supplied to those residential dwellings.[25]

23. The weighted average price per unit[26] on heat networks in our sample was 6.0 p/kWh and the median network price per unit was 4.8 p/kWh.[27] However, the price per unit varied substantially, as shown in Figure 1. Due to a small number of extreme values[28] we considered that it was informative to calculate the interquartile range, which was between 3.9 p/kWh[29] and 7.8 p/kWh.[30]

Figure 1: Distribution of price per unit across our sample

[24] We also included charges that related to the supply of heat to end customers but were levied on other parties (e.g. a landlord) on the assumption that such charges may be passed on to end customers. In the event, only 4% of heat networks made charges to intermediaries and, across our sample, they represented only 3% of all heat charges.
[25] A small number of heat suppliers stated that they could not exclude communal areas from heat supplied and heat charge information. This will slightly inflate our estimates of annual heat charges for individual dwellings although we consider that this is unlikely to have a significant impact on price per unit estimates.
[26] That is, the sum of all charges for the supply of heat to residential dwellings on networks within the sample divided by the sum of heat supplied to residential dwellings within the sample.
[27] The figures in this paragraph are based on a sample of 427 heat networks. Of the 445 heat networks that we received information on, 18 were excluded that either: provided a figure of zero for heat supplied to residential customers, or a figure of zero for the total amount charged to residential customers.
[28] The minimum price per unit was 0.4 p/kWh and the maximum price per unit was 126 p/kWh.
[29] The price per unit of the heat network corresponding to the 25th percentile.
[30] The price per unit of the heat network corresponding to the 75th percentile.

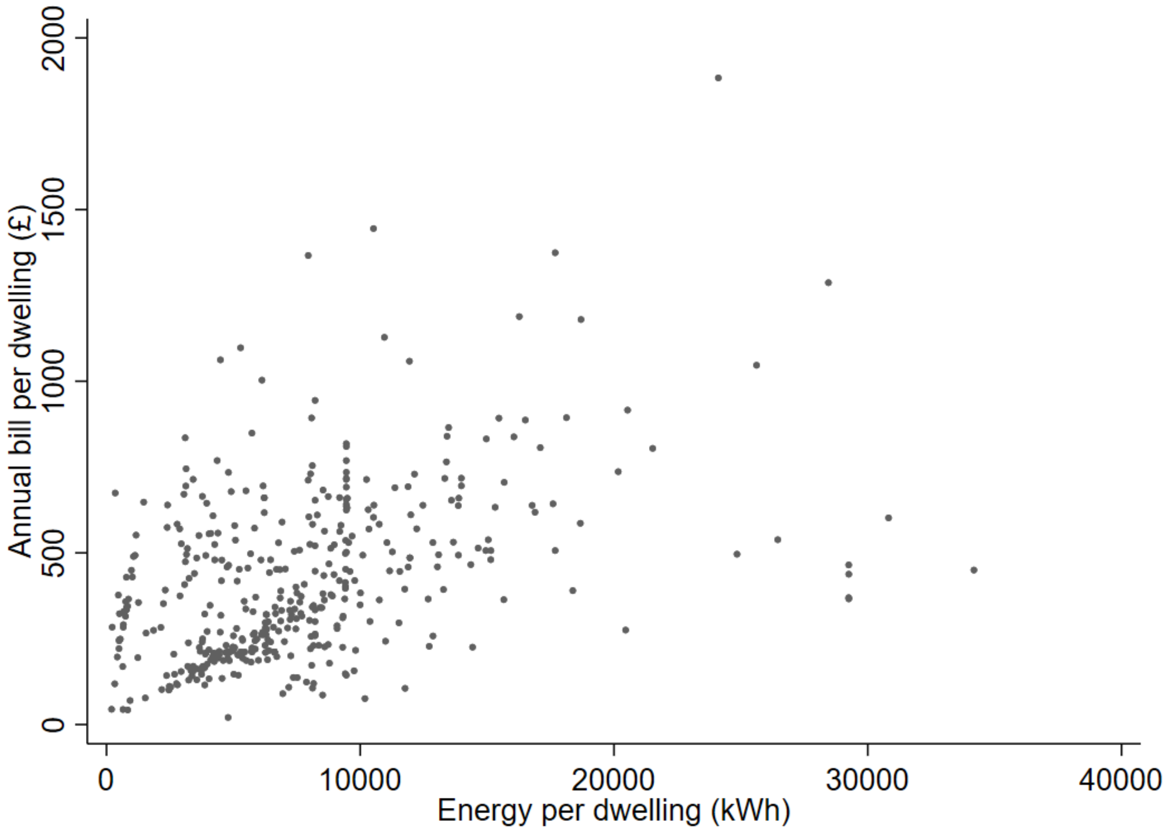


Source: CMA Supplier Questionnaire.
Notes: Data shown for 424 heat networks. In addition to the 18 heat networks excluded for the reasons explained in footnote 26, 3 networks that charged more than 60 p/kWh are not shown

24. We also calculated annual charges for heat per dwelling on each network by taking the total sum of all charges on that network and dividing through by the number of residential dwellings. The weighted[31] average value was £420 and the median was £366.[32] As shown in Figure 2, the range of average annual charges was also very wide,[33] with an interquartile range of between £225 [34] and £570.[35]

Figure 2: Average annual heat charge per dwelling

[31] That is, the sum of all charges for the supply of heat to residential dwellings on networks within the sample divided by the number of residential dwellings within the sample (we asked for dwellings to be included only if they were not vacant for the whole year although some heat suppliers stated that they could not verify this).
[32] The figures in this paragraph are based on a sample of 425 heat networks. Of the 445 heat networks that we received information on, 20 were excluded that either: did not provide information on the number of dwellings, or provided a figure of zero for the total amount charged to residential customers.
[33] The minimum average annual heat charge of £21 and maximum average annual heat charge of £9,345.
[34] The average annual charge of the heat network corresponding to the 25th percentile.
[35] The average annual charge of the heat network corresponding to the 75th percentile.



Source: CMA Supplier Questionnaire
Notes: Data shown for 420 heat networks. In addition to the 20 heat networks excluded for the reasons explained in footnote 31, five heat networks are not shown where the average heat per dwelling exceeded 40,000 kWh.

Comparison to an individual gas boiler

Introduction

25. We compared what customers paid for heat in our sample to the costs that they might have faced if heating and hot water had been supplied by an individual gas boiler.

26. In our view, individual gas central heating provides a useful benchmark as most GB households (around 85%)[36] use mains gas for heating. A comparison between prices on heat networks and prices with individual gas boilers therefore gives an indication of whether heat networks are offering value for money for customers.

27. It is important to note that our gas comparator does not necessarily reflect the alternative (or 'counterfactual') cost that heat network customers would

[36] Insights paper on households with electric and other non-gas heating, Ofgem, 2015, table 1.

actually face, particularly where gas central heating is not the most likely alternative.

28. It is also not intended to reflect the price that would prevail in a competitive heat network market. In particular, the costs of building and operating a heat network may differ greatly from those of alternative sources of heat, depending (among other things) on the types of property involved and the size of the heat network.

29. Our comparison of heat network charges with the costs of individual gas boiler heating cannot therefore distinguish between poor outcomes for customers that result from misaligned incentives of parties (resulting in a suboptimal heating solution from customers' perspective) and poor outcomes caused by the monopoly power of heat networks.[37]

Construction of gas comparator

30. We constructed a gas comparator using assumptions similar to those used in the Heat Trust's calculator.[38] This comparator (Comparator 1) assumes average UK gas tariffs, which reflect the fact that a majority of customers in the UK pay (relatively high priced) Standard Variable Tariffs. This therefore does not reflect the lowest prices available to those using an individual gas boiler, and represents a relatively generous benchmark, on both a per unit and annual charges basis. We therefore also calculated another gas comparator using assumptions that result in a lower price of heat (Comparator 2). For this comparator, we assumed a lower (by about 14%) gas tariff and similarly adjusted assumptions on other factors that impact cost (the lifespan of the boiler, boiler efficiency and the propensity for customers to take out boiler service cover).

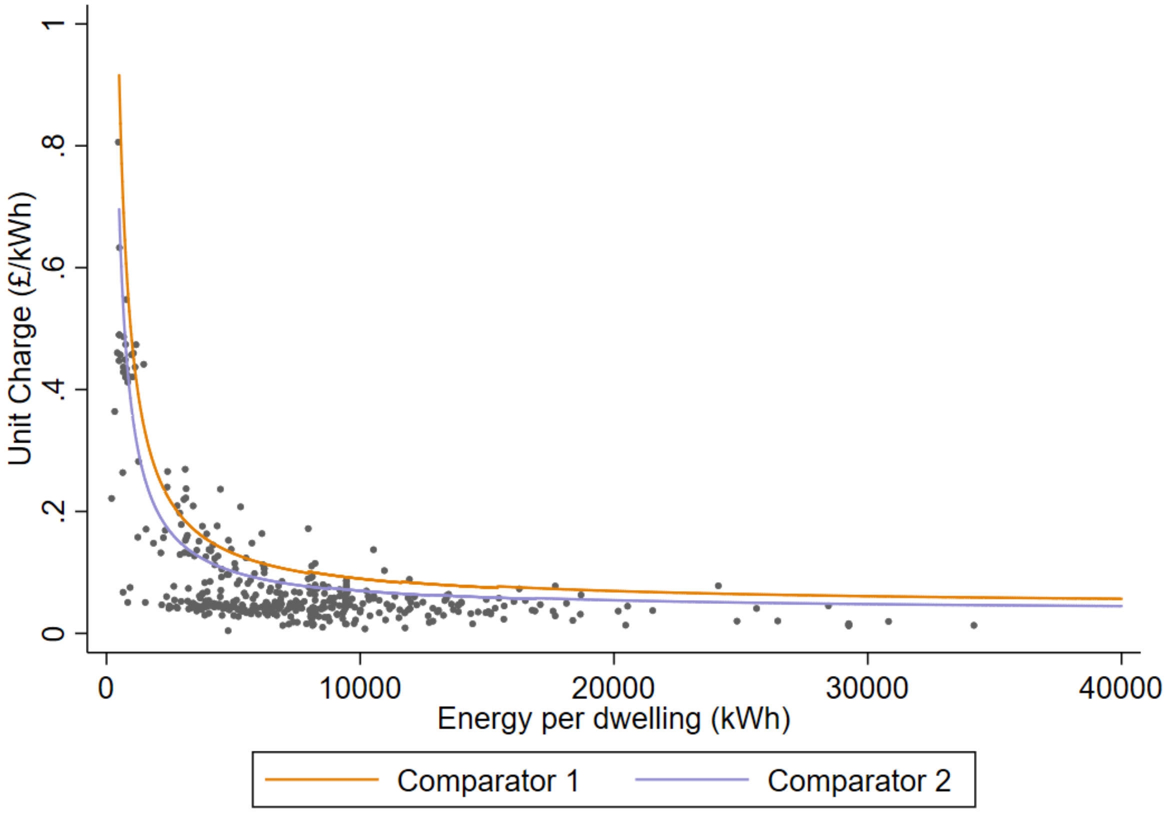
31. Both comparators took into account heat consumption per dwelling because the price per unit of heat from using an individual gas boiler falls with higher consumption (as the fixed costs of owning and maintaining a boiler are spread over the higher volume of heat). The assumptions underpinning both comparators are set out in the Technical Annex to this Appendix.

[37] To investigate the prevalence of the former would require in-depth analysis of the technical specifications of efficient heating solutions; to investigate the latter, we would need to compare prices charged with underlying costs. See discussion from paragraph 1.14 of the main report.
[38] Heat Cost Calculator: Further information and background assumptions, Heat Trust, 2016.

Results

32. Figure 3 below shows the average price per unit of heat on each heat network in our sample, plotted against the average heat consumption per dwelling on that network. Also shown are our Comparator 1 and Comparator 2. Figure 4 shows the same information, but expressed as an average annual heat charge per dwelling.

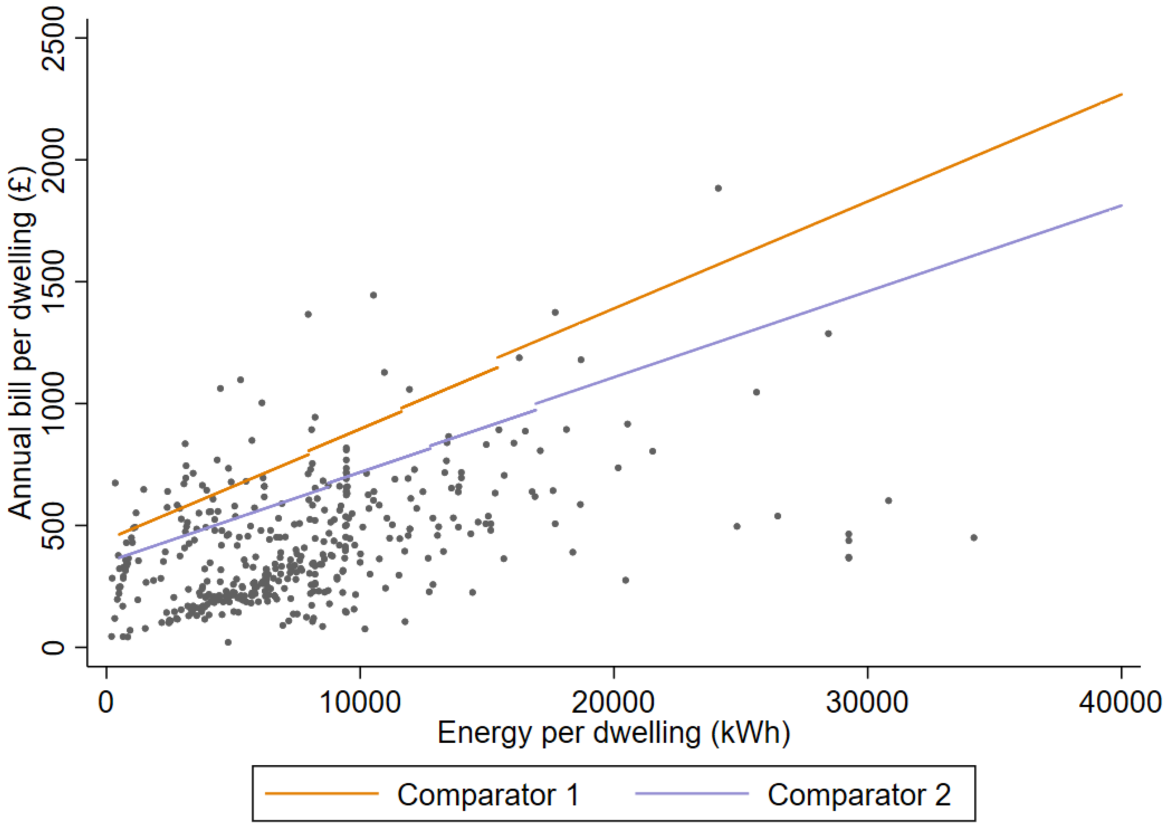
Figure 3: Average price/cost per unit of heat



Source: CMA Supplier Questionnaire.

Notes: Data shown for 418 heat networks. In addition to the 20 heat networks excluded for the reasons explained in footnote 31, five networks with an average heat per dwelling exceeding 40,000 kWh and 2 network that charged more than 100 p/kWh are not shown.

Figure 4: Average annual heat charge per dwelling



Source: CMA Supplier Questionnaire.
Notes: Data shown for 420 heat networks for the same reasons as in Figure 2.

33. We recognise that there are limitations in comparing heat network prices to these gas comparators. Nevertheless, overall, these charts indicate that the average prices paid on the large majority of heat networks within our sample are close to or lower than our gas comparators.

34. A large proportion of networks, 53% (and 52% of dwellings), were charged an average price per unit and annual heat charge that was less than half the level of Comparator 1. A further 27% of networks (and 24% of dwellings) had unit prices between 25% and 50% lower than Comparator 1. Only 8% of networks had unit prices above Comparator 1. 6% of networks (and 6% of dwellings) were charged over 10% more, and 3% of networks charged over 25% more than Comparator 1.

35. Even for Comparator 2, 39% of networks (and 37% of dwellings) were charged an average price per unit and annual heat charge that was less than half the cost of this gas comparator. 17% of networks had unit prices above Comparator 2. 13% of networks (and 17% of dwellings) were charged over

10% more, and 8% of networks (and 9% of dwellings) were charged over 25% more than Comparator 2.

Comparison by type of heat network

36. We considered whether there was evidence that customers systematically pay more for heat on certain types of heat network. We compared how prices and charges vary according to:

(a) Whether dwellings are individually metered or not;

(b) The type of organisation that operates the heat network;

(c) Whether the heat network is a district or communal network;

(d) The size of the heat network;

(e) The age of the heat network;[39]

37. Our analysis focused on the price per unit of heat supplied. We also took into account the annual heat charges per dwelling. The latter have the advantage that they do not rely on an estimate of heat supplied (which as discussed can be difficult). On the other hand, differences between average annual charges per dwelling may be explained by different levels of heat consumption rather than differences in prices charged.

38. Taking these factors into account, we found that privately operated networks and those networks with individual metering were both associated with substantially higher unit prices and substantially higher annual charges when compared to the sample overall:

(a) The total sample weighted mean price per unit was 6.0 p/kWh, whilst for privately operated schemes it was 8.9 p/kWh and for metered schemes it was 9.0 p/kWh. The median price per unit was: 4.9 p/kWh for the total sample; 7.8 p/kWh for private schemes; and 7.7 p/kWh for metered schemes;

(b) The total sample weighted mean annual heat charge was £420, whilst for privately operated schemes it was £448 and for metered schemes it was £479. The median annual heat charge was: £366 for the total sample; £562 for privately operated schemes; and £480 for metered schemes.

[39] We had also planned to compare prices between heat networks that use different technologies but could not undertake a meaningful analysis as almost all networks within our sample use gas boilers.

39. We note that privately operated networks in our sample were substantially more likely than average to be individually metered, and vice versa, so our observations may be driven by some of the same factors.

40. With regard to privately operated networks, they differentiate themselves from the sample overall in terms of:

(a) Being relatively new – 58% of privately operated networks were built since 2000;

(b) Supplying high rise buildings – 64% of buildings on privately operated networks are located in buildings with five or more storeys compared to 38% overall;

(c) Having a relatively high proportion, 42%, of networks with individual metering**;**

(d) Supplying larger dwellings (ie with more bedrooms);

(e) Having a substantial proportion, 23%, that set prices with comparison with other heat sources (as opposed to some estimate of costs).

41. Prices and charges will, to some extent, be driven by the average heat consumption per dwelling. To try to understand whether this may explain the results above, we compared the prices and charges of these networks to our gas comparators at the relevant level of average heat consumption for each network.

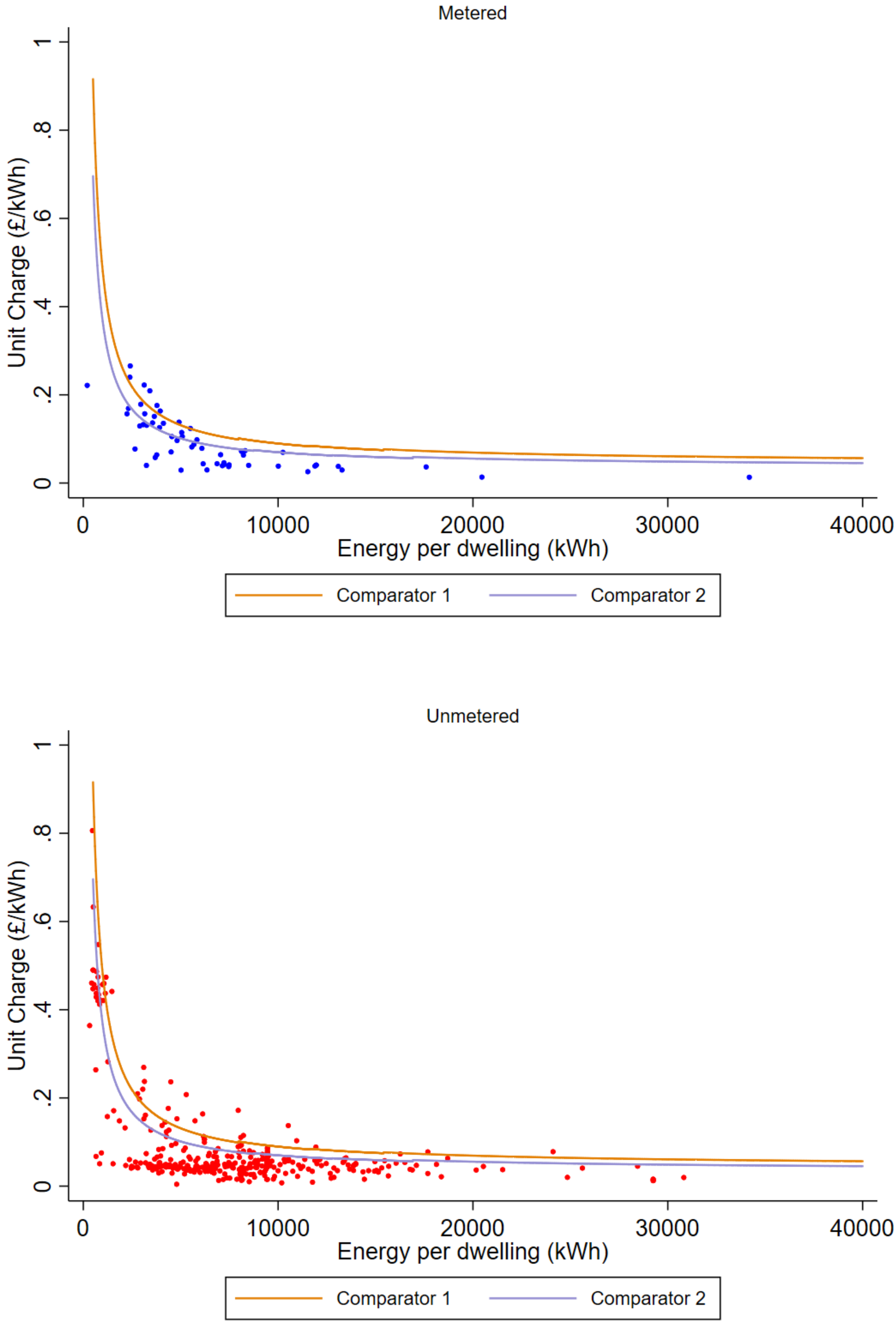
42. This analysis indicated that the higher prices and charges on private and metered networks are not (or at least not only) due to the underlying level of heat consumption. We found that privately operated networks and metered networks tend to have higher prices and charges relative to the gas comparators, compared to networks across the sample as a whole.[40]

43. As shown in Figure 5 and Figure 6 below, a relatively higher proportion of these types of heat networks charge more than the gas comparators. For instance, 27% of privately-operated networks, and 16% of metered schemes, had prices higher than Comparator 1. 50% of privately-operated schemes, and 31% of metered schemes had prices higher than Comparator 2. It is important to note, however, that the sample sizes for these two groups (ie

[40] We assessed this by calculating, for each heat network, the ratio of the price per unit of heat compared to the Comparator 1. The median ratio across the whole sample was 0.47 compared to 0.77 for private schemes and 0.67 for metered schemes. We also calculated equivalent ratios using Comparator 2, in which the median values were 0.59 for the whole sample, 0.96 for private schemes and 0.84 for metered schemes.

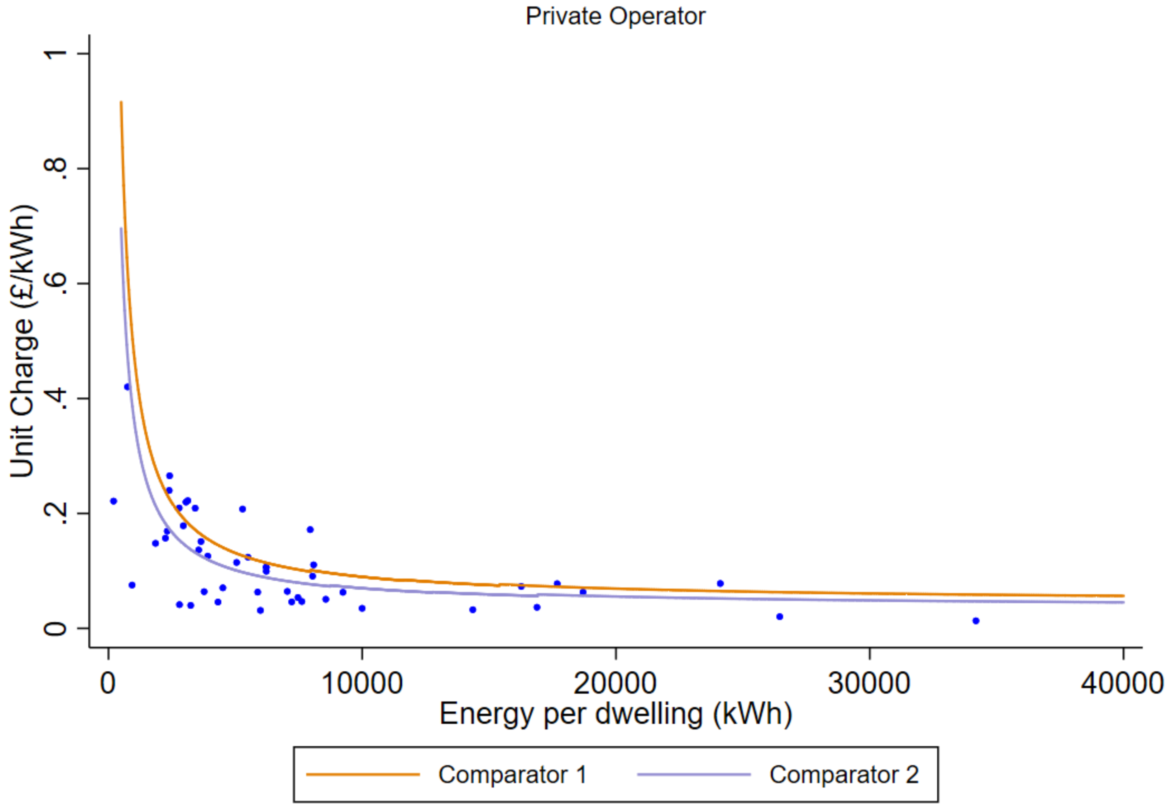
private and individually-metered) are quite small. Therefore, the sample analysis of these heat networks may be less reliable indicators of the wider population of private and metered networks (ie compared to the analysis of the overall sample).

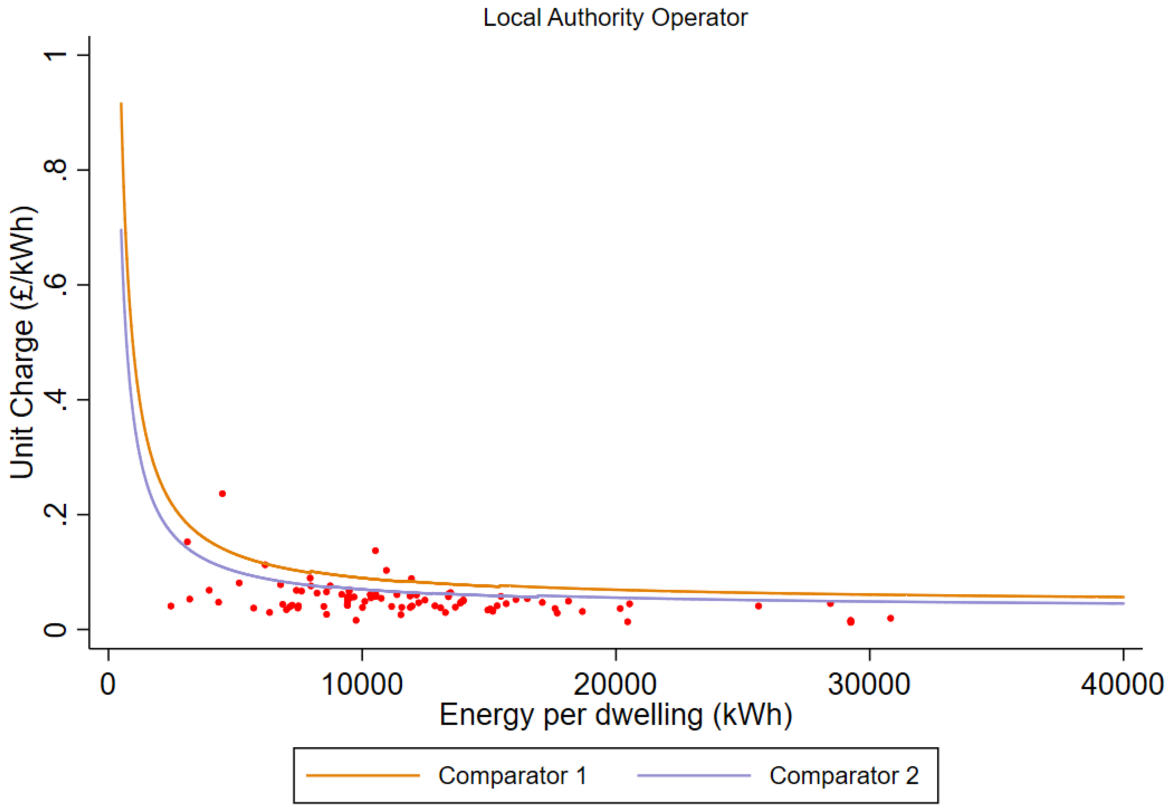
Figure 5: Prices for metered and unmetered schemes

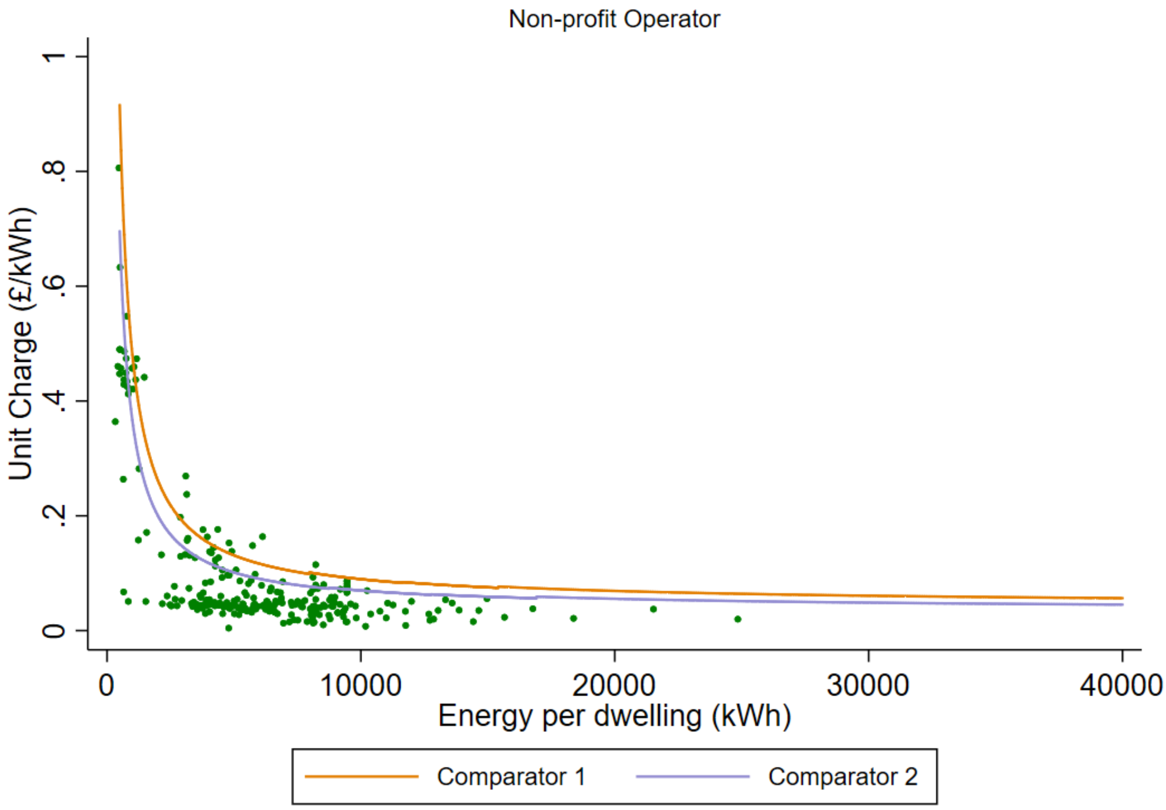


Source: CMA Supplier Questionnaire.
Notes: see notes for Figure 3.

Figure 6: Prices by type of operator







Source: CMA Supplier Questionnaire

Notes: see notes for Figure 3

Technical Annex to Appendix A: Derivation of the CMA gas comparators

44. We set out in this section how we constructed the gas comparators used in the pricing analysis. As noted in Appendix A, we constructed two different gas comparators: one that results in a relatively high level for the price of heat supplied (Comparator 1) and one that results in a lower price (Comparator 2), to give benchmarks against which we could compare the prices charged by heat networks.

45. We used the same components to construct both gas comparators, but with slightly different assumptions. We calculated both gas comparators using the following formula:

$$p(gas) = annualised\ boiler\ cost + standing\ charge + \left(\frac{heat\ consumption}{boiler\ efficiency}\right) gas\ unit\ price$$

46. Below we set out in more detail the assumptions we used in constructing these two comparators.

Annualised boiler cost

47. In estimating the upfront cost of a gas boiler, we used the Heat Trust calculator's figures for the average price of a boiler for four different sizes of property.[41] By taking an average of the online prices for a number of boilers that would be appropriate for each property type, the Heat Trust determines the average upfront price of a boiler for each of these four categories of property. Average upfront boiler prices range from £830 for the smallest category of property to £1,477 for the largest. We calculated the average consumption per dwelling on each heat network in our sample, and used the Heat Trust's figures to estimate the upfront cost of a boiler for a property with that level of consumption.

Comparator 1

48. For the baseline comparator, we used the Heat Trust's assumption that boiler installation costs are £600, that the useful life of a boiler is 11.2 years (the average useful life of UK boilers), and that annual boiler cover costs £205.30. While we recognise that many customers may not pay for full cover (and annual servicing) of boilers, the service provided by heat networks effectively

[41] Heat Cost Calculator – Further information and background assumptions, 2016, Heat Trust.

includes full cover of the heating system, so we include this in order to make a like-for-like comparison.

49. We annualise the upfront costs using a discount rate of 3.5%, in line with HM Treasury's Green Book.[42]

Comparator 2

50. For the lower gas comparator, we used the same upfront boiler costs and installation costs used by the Heat Trust calculators, but relaxed 2 of the other assumptions: First, we assumed that the useful life of boilers is higher than the UK average, at 15 years. This was on the basis that we assume that the boiler is serviced regularly and is fully insured. As a result, we consider it reasonable to assume that it may last slightly longer than the UK average. For the lower comparator, we also assumed that the boiler would not need to be serviced or insured for the first 2 years after it was purchased (indeed, it may be covered by a manufacturer's warranty for this period).

Gas tariff: standing charge and gas unit price

Comparator 1

51. We used the BEIS Average variable unit costs and standing charges for gas in 2016 for regions in Great Britain statistics for the gas tariff in our baseline comparator.[43] We took the GB average direct debit prices.

52. In calculating the average tariffs, BEIS weights each available tariff by the proportion of customers on it.[44] Since the majority of customers are on (high-priced) Big 6 Standard Variable Tariffs (SVTs), the average tariff is higher than the best-available price of gas for domestic customers.

53. In line with the Heat Trust calculator, we used the direct debit price (which is lower than the standard credit / overall average) published in the BEIS statistics.

Comparator 2

54. In the CMA's Energy Market Investigation, the CMA set a price cap for gas and electricity customers on prepayment meters.[45] This price cap was set at a

[42] The Green Book, HM Treasury, page 7.
[43] Quarterly Energy Prices Tables Annex, BEIS, December 2016, table 2.3.4.
[44] Domestic Energy Prices: Data sources and methodology, BEIS, section 3.1.2.
[45] CMA Energy Market Investigation, Final Report, paragraph 11.79.

level that would ‘materially reduce detriment for prepayment customers’ but that ‘included a level of headroom that will help ensure that competition in the prepayment segments can coexist with the cap’.[46] We consider that for the purposes of Comparator 2, it is appropriate to use a gas price based on the prepayment price cap model.[47] We therefore adjusted the price cap model to give a GB average direct debit gas tariff to cover calendar year 2016 to use in Comparator 2. At the Typical Domestic Consumption Value for gas of 12,000 kWh/year, this results in the gas prices in Comparator 2 being around 14% lower than those used in Comparator 1.

Boiler efficiency

Comparator 1

55. For the baseline gas comparator, we assumed that boilers were 82% efficient. This reflects the average efficiency of UK boiler stock, and is in line with the approach used by the Heat Trust.

Comparator 2

56. For the lower comparator, we assumed that the efficiency of gas boilers was 90% - in line with the efficiency of a new, modern gas boiler.[48]

[46] CMA Energy Market Investigation, Final Report, paragraphs 11.100-11.101.
[47] CMA Energy Market Investigation, Illustrative price cap model spreadsheet.
[48] Which? notes here that ‘most of the boilers you can buy now are between 88% and 91% efficient’.

Appendix B: Heat network quality

Introduction

57. In this appendix, we set out our findings on the quality of service experienced by customers on heat networks. In our view, there are a number of factors that are likely to affect quality of service. We therefore consider quality of service under the following three broad themes: overall satisfaction, technical service quality (eg reliability of heat and hot water provision, issues with overheating, etc), and other measures of service quality (eg quality of information, billing, responses to complaints).[49]

58. We used a number of different sources of evidence to develop our findings in this section. Our main sources of evidence are:

    (a) The BEIS survey of 5,502 individuals (3,716 on heat networks and 1,786 customers not on heat networks).[50] This survey is particularly useful, as it enables us to compare the experience of individuals on heat networks to that of individuals who receive heating from other sources.

    (b) The results of our supplier questionnaire, for which we received responses from 68 suppliers, covering a total of 445 heat networks.[51] In the questionnaire, we asked suppliers about the prevalence of interruptions to the service.

    (c) Consumer complaints we received in response to our Statement of Scope.

    (d) The Which? report on heat networks, which summarises the findings of its qualitative research, based on three focus groups involving a total of 50 participants, and a further five phone interviews.[52]

    (e) The qualitative research we commissioned from Kantar Public (summarised in Section 6 of the report).[53]

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[49] This is broadly in line with the categories used in the BEIS survey, which is one of the main sources of evidence discussed in this section – see below for more detail.
[50] BEIS Research Paper Number 27; Heat Networks Consumer Survey, Results Report; December 2017 ('BEIS Report').
[51] See Appendix A for more information about our supplier questionnaire.
[52] Which?; Turning up the heat: Getting a fair deal for District Heating users; March 2015 ('Which? Report').
[53] Kantar Public, Qualitative Research: Heat Networks ('Kantar report'). We note that there are a number of limitations to the Kantar research findings, relating to final sample composition: (a) The

59. The structure of this section is as follows:

(f) First, we consider the available evidence regarding customers' overall satisfaction with heat networks.

(g) Second, we examine aspects of the technical service quality of heat networks, both as reported by heat network customers (through the BEIS survey) and by heat networks themselves (through the responses to our questionnaire).

(h) Third, we consider the other areas that feed into service quality, such as availability of information, billing, access to redress, etc.

(i) Finally, we set out our conclusions relating to the service quality experienced by customers on heat networks.

Overall satisfaction

60. In this section, we summarise the available evidence relating to customers' overall satisfaction with their heating system.

Evidence from BEIS survey

61. The BEIS survey indicated that overall satisfaction among heat network customers is generally high: 74% of heat network customers stated that they were either 'satisfied' or 'very satisfied'. For respondents who were not served by heat networks, the equivalent percentage was similar, at 72%.[54]

62. Likewise, a similar percentage of heat network and non-heat network customers were either 'dissatisfied' or 'very dissatisfied' (13% and 14% respectively).[55]

63. The survey therefore indicated that customers on heat networks do not appear to have lower levels of satisfaction with their heating systems than customers who are not on heat networks.

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research included consumers that had moved more than three years ago, limiting their recall of the exact information received during the home move journey; (b) The sample did not include an even spread of tenure. It mainly consisted of owner occupiers and housing association tenants. Only one local authority tenant and two private renters were recruited, meaning that findings for these tenures are indicative rather than conclusive; (c) Out of 11 owner occupiers, four had previously complained to the CMA, which might be why experiences of owner occupiers in our sample are more negative than those of other groups of respondents.

[54] The difference is not statistically significant. BEIS Report, p27, Figure 1.

[55] BEIS Report, p27, Figure 1.

64. The survey also showed that satisfaction is higher on communal heating schemes than on district heating schemes, with the percentage of customers who were either ‘satisfied’ or ‘very satisfied’ at 78% and 71% respectively.[56]

65. Furthermore, customers on heat networks operated by Housing Associations (HAs) exhibited higher levels of satisfaction than those on heat networks operated by private companies or local authorities (LAs). 81% of customers on HA-operated schemes were ‘satisfied’ or ‘very satisfied’ compared to 71% of customers on private schemes and 72% of customers on LA-operated schemes.[57]

66. Econometric analysis undertaken by BEIS showed that satisfaction is linked primarily to the reliability of schemes, the perceived fairness of pricing, customers’ satisfaction with the information provided about their schemes and customers’ satisfaction with handling of complaints.[58]

67. Finally, the BEIS survey indicated that heat network customers’ thoughts on the fairness of prices was similar to that of customers not served by heat networks. 60% of both heat network customers and customers not served by heat networks indicated that they thought the prices they paid were either ‘fair’ or ‘very fair’.[59] Likewise, a similar percentage of customers in both groups thought that their prices were either ‘not very fair’ or ‘not at all fair’ (36% of customers on heat networks, compared to 35% of customers who were not on heat networks).[60] In addition, heat network customers’ views appeared to be slightly more polarised, with a greater percentage of respondents stating they were either ‘very fair’ or ‘not at all fair’.[61]

Evidence from Which? report

68. The qualitative study set out in the Which? report indicated that satisfaction with heat networks is mixed, and that customers’ attitudes tend to be ‘polarised’. The report noted that ‘consumer satisfaction varies significantly between schemes, but consumers on the same scheme generally have similar views’.[62]

[56] BEIS Report, p27.
[57] BEIS Report, p26.
[58] BEIS Report, p29.
[59] BEIS Report, p55, Figure 14.
[60] BEIS Report, p55, Figure 14.
[61] BEIS Report, p55, Figure 14.
[62] Which? Report, p10.

69. The report noted a lack of confidence among many customers that prices charged are fair. It set out that ‘this was fuelled by a lack of transparency in how [customers’] bills were derived, concerns over unfair charges and doubts over the efficiency of their network’.[63]

70. The report also noted that there is a lack of understanding among some consumers around how bills are calculated. In addition, ‘metered consumers universally felt that their standing charges were too high and this was a particular source of frustration for those with low usage’.[64]

71. Some customers in new builds that were not yet fully occupied suspected that they were paying more as ESCos were trying to recover costs from a small customer base.[65]

72. Customers also raised concerns relating to the efficiency with which heat networks were run. For example, ‘consumers at several schemes complained that heat was being wasted, including on communal areas’.[66]

73. The report also noted customers’ concerns with their inability to switch supplier. It noted that ‘for some participants, the fact they cannot switch supplier is a problem and fuels their suspicion that they are being “ripped off”’.[67]

74. Finally, Local Council involvement in district heating schemes gave some customers reassurance that pricing was fair; for others, this was a reason to lack confidence in the scheme.[68]

Evidence from CMA qualitative research

75. Our qualitative research indicated that customers in LA- and HA-operated schemes[69] tended to have had a better experience than those on private schemes.[70] It suggested that this is because customers on LA- and HA-operated schemes tended to have fewer disruptions to their heat, and did not have to deal directly with suppliers regarding billing and maintenance.[71]

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63 Which? Report, p10.
64 Which? Report, p10.
65 Which? Report, p10.
66 Which? Report, p11.
67 Which? Report, p11.
68 Which? Report, p11.
69 Note that only one local authority tenant took part in this research.
70 Kantar report, p18. Note that 4 out of 11 owner occupiers in the sample had previously complained to the CMA, which might explain why their experiences were negative that those of other sub-groups of customers.
71 Kantar report, p18.

Technical service quality

76. In this section we set out the available evidence relating to the technical quality of service. As set out above, this includes the reliability of the system (eg the number of outages), and other measures relating to the technical characteristics of the system (eg the availability of hot water and the level of over- and under-heating).

Evidence from BEIS survey

77. Regarding reliability, the BEIS survey showed that a greater proportion of heat network customers had experienced a loss of heating in the last 12 months (37%) compared to customers not served by a heat network (24%).[72]

78. The results of the BEIS survey suggested that the perceived reliability of the heating system is similar for heat network and non-heat network customers. 93% of heat network customers and 90% of customers who were not on heat networks said their heating system was either 'very reliable' or 'fairly reliable'.[73]

79. The survey noted that customers on communal heating systems tended to view their system as more reliable than those on district heating systems. 60% of customers on communal heating systems stated that their system was 'very reliable', compared to 51% of customers on district heating systems.[74]

80. Customers on networks operated by HAs were most likely to rate their service as 'very reliable' (66% of customers), with fewer customers on privately- and LA-operated schemes rating their service as 'very reliable' (53% and 50% respectively).[75]

81. The survey indicated that heat network customers have less control over their level of heating than customers who are not on heat networks.[76] It also indicated that heat network customers were more likely to report over-heating than those not on heat networks (39% and 22% respectively reporting that their home had been uncomfortably warm in the past).[77]

[72] BEIS Report, p38.
[73] BEIS Report, p31, Figure 2.
[74] BEIS Report, pp31-32
[75] BEIS Report, p31.
[76] BEIS Report, p39.
[77] BEIS Report, p32.

82. In contrast, only 16% of customers on heat networks stated that their home ever got uncomfortably cold, compared to 29% of customers not served by heat networks.[78]

83. Overall, customers' satisfaction with their ability to control their level of heating was effectively the same for customers on heat networks and those who are not: 71% of both groups were either 'satisfied' or 'very satisfied' with their level of control, while 14% of both groups were either 'dissatisfied' or 'very dissatisfied'.[79]

Evidence from CMA supplier questionnaire

84. Our results broadly fit with the findings of the BEIS survey: we found that 32% of all networks in our sample had experienced an interruption to the supply of heating and/or hot water in 2016, compared to 37% of heat network customers having experienced an outage in the previous 12 months in the BEIS survey.

Variation across type of network operator

85. Our analysis (see Table 1 below) shows that just over half of privately-operated networks (52%) experienced an interruption during 2016. In contrast, only 27% of heat networks operated by non-profit organisations experienced an interruption during the same period. In the same period, 39% of Local Authority operated networks experienced an interruption.

Table 1: percentage of networks experiencing at least one interruption to service during 2016, by party operating the network

	Networks experiencing at least one interruption in 2016 (%)
Local Authority	39
Non-profit	27
Private	52

Source: CMA analysis of questionnaire responses

86. Table 2 below shows for the networks that reported at least one interruption during 2016, the average number of interruptions experienced for networks operated by different types of entity. It shows that heat networks operated by LAs and non-profit entities that had at least one interruption during 2016 experienced an average of 2.2 and 2.1 interruptions respectively during the

[78] BEIS Report, p34.
[79] BEIS Report, p40.

same period. Privately operated networks with at least one interruption during the period experienced an average of 3.9 interruptions over the course of the year.

Table 2: average number of interruptions for those networks that reported at least one interruption during 2016, by party operating the network

	Average number of interruptions in 2016
Local Authority	2.2
Non-profit	2.1
Private	3.9

Source: CMA analysis of questionnaire responses

Variation by type of network

87. We also considered the extent to which different types of heat network – communal heating and district heating – experienced different levels of reliability. The results of our questionnaire indicate that district heating networks were much more likely than communal heating networks to have experienced an interruption during 2016. See Table 3 below.

Table 3: percentage of networks experiencing at least one interruption to service during 2016, by type of network

	Networks experiencing at least one interruption during 2016 (%)
Communal	28
District	46

Source: CMA analysis of questionnaire responses

88. In addition, those district heating networks that experienced at least one interruption during the period had on average just over 50% more interruptions to service. As set out in Table 4 below, district heating networks that had at least one interruption during the year had an average of 3.2 interruptions, compared to 2.1 for communal heating systems.

Table 4: average number of interruptions for those networks that reported at least one interruption during 2016, by type of network

	Average number of interruptions in 2016
Communal	2.1
District	3.2

Source: CMA analysis of questionnaire responses

Evidence from Which? report

89. The Which? report set out that participants had mixed views relating to the technical service quality of their heat networks. Some customers were pleased with the performance of their heat networks, while others had experienced issues.

90. Which? noted that 'common complaints included being too hot, there being no hot water, hot water running out quickly or it taking a long time for water to run warm'.[80] The report set out that 'the most common complaint we received about system performance was that temperatures were too high'.[81] This was not only the case for older, non-metered networks, but these issues also arose in newer schemes.[82]

Evidence from CMA qualitative research

91. Our qualitative research indicated that nearly all[83] customers who owned their properties had experienced disruptions to their heating supply. Kantar noted that 'respondents felt these disruptions were not resolved in a timely manner, and that the supplier lacked transparency about what was being done to resolve issues'.[84]

92. On the other hand, LA and HA tenants tended to experience fewer disruptions to their heating.[85]

Evidence from submissions and complaints made to the CMA

93. Technical service quality concerns are a consistent theme of consumer complaints to the CMA with over half of those complaints analysed so far

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80 Which? Report, p12.
81 Which? Report, p12.
82 Which? Report, p12.
83 As mentioned, four out of 11 owner occupiers in the sample had previously complained to the CMA, which might at least partly explain why experiences of this group were particularly negative.
84 Kantar report, p19.
85 Kantar report, p18.

referring to supply concerns. In particular, most of those complaints that refer to service quality refer to unplanned interruptions. Less frequently mentioned concerns include excessive noise, insufficient heat or hot water and malfunctioning meters. Technical service quality is second only to complaints and concerns about price aspects. Several of the complaints emphasise that the loss of hot water and heat can have a severely detrimental effect on everyday life from 'ruining' plans for a weekend to making it difficult to invite friends and family to visit.

94. Reflecting the importance of the reliability of utilities for everyday life, consumer groups have also emphasised the importance of technical service quality to the CMA in meetings with the CMA and in their responses to the statement of scope.[86] This evidence suggests that when heat problems occur they can create significant dissatisfaction and distress to those consumers affected.

Other measures of service quality

95. In this section, we set out the available evidence relating to customers' perceptions of other measures of service quality. This includes the extent to which customers have access to bills and other information, and the extent to which customers feel able to complain about their service and have access to redress.

Evidence from BEIS survey

Billing and access to information

96. The BEIS survey identified that customers on heat networks were less likely to receive bills, account summaries or statements detailing their charges for heat and hot water than those who were not on heat networks. The survey showed that 62% of customers on heat networks received this sort of information about charges, compared to 81% of customers who were not on heat networks.[87]

97. Of those who did receive a bill (or similar), 74% of customers thought that the level of information they received on their bills was 'about right' (which was similar to the equivalent proportion among customers not on heat networks, 79%).[88] 18% of heat network customers receiving a bill thought the amount of

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[86] For example, see Fuel Poverty Action's response and documents referred to in the response.
[87] BEIS Report, p43.
[88] BEIS Report, p50.

information contained on the bill was 'too little', compared with 14% of customers who were not served by a heat network. Customers on networks that are registered with the Heat Trust were more satisfied with the level of information they received than customers of non-Heat Trust registered networks. Among customers of Heat Trust registered networks who received a bill, 12% thought the bill included too little information compared with 21% of customers on heat networks that are not registered with the Heat Trust.[89]

98. Customers on heat networks were slightly less likely than customers not on heat networks to have received information about the type of heating system they have (41% compared to 47%).The opposite is true for customers on networks operated by companies registered with the Heat Trust, where 69% of customers had received information about the type of heating system they have.[90]

99. However, customers on heat networks were more than twice as likely as customers not on heat networks to have received information about the likely cost of their heating (20% compared to 9%).[91]

Complaints and access to redress

100. A slightly higher proportion of customers on heat networks had made a complaint about their heating system in the last year (22%) than customers not on heat networks (18%).[92]

101. In addition, of those who had made a complaint, customers on heat networks tended to be less satisfied with how the complaint was handled than customers not on heat networks: only 45% of customers on heat networks who made a complaint were either 'satisfied' or 'very satisfied' with how their complaint was handled, compared to 56% of customers not on heat networks.[93]

Evidence from Which? report

Billing and access to information

102. As with the other areas of service quality discussed above, the Which? report shows that customers have mixed experiences in relation to the information

[89] BEIS Report, p50.
[90] BEIS Report, p60.
[91] BEIS Report, p60.
[92] BEIS Report, p63.
[93] BEIS Report, p64.

available to them; some customers thought that they received sufficient information, while others did not.

103. The report noted that 'some consumers had received all the information they needed from their heat supplier and/or landlord', while 'other participants said they had received insufficient or confusing information about how the scheme works and what to do when there is a problem'.[94]

104. Regarding the information available to customers before they moved in, the Which? report set out that 'several consumers stated that the information they received about district heating before purchasing their property was poor or misleading'.[95]

105. The report also set out that 'some consumers said they found how they were billed, and what their bill said, unclear and confusing'.[96]

Complaints and access to redress

106. Customers had mixed views of the process for complaining about their heating systems, with some customers reporting a positive experience and others reporting a less positive experience.

107. Some customers reported frustrations that there was no single point of contact when something went wrong with their heating: 'several participants said they had been "passed around" and that there was a lack of clear information on which organisation was responsible for what'.[97]

108. The report noted that some customers were concerned that they did not have access to an ombudsman for when they had ongoing disputes with their heat network operator.[98]

Evidence from CMA qualitative research

109. In our qualitative research some respondents reported receiving bills at irregular intervals, often with large gaps in between, resulting in some very high bills. Others had not received expected billing statements and were not able to access their past statements.[99]

[94] Which? Report, p12.
[95] Which? Report, p13.
[96] Which? Report, p13.
[97] Which? Report, p14.
[98] Which? Report, p14.
[99] Kantar report, p19.

110. Our research also indicated that some customers had experienced poor customer service from their suppliers. It set out that 'respondents described the sometimes confrontational nature of interactions, inconsistency of information provided to consumers on the same network, and difficulty finding the right person'.[100]

Evidence from submissions and complaints made to the CMA

111. A significant proportion of the complaints to the CMA analysed for this reportrefer to concerns about billing. About one third of complaints refer to irregular bills, a third complain about inaccurate bills and a significant proportion complain about being billed for heat consumption when they believe that they are not using so much heat, or any heat and hot water. It is important to note the depth of feeling in such complaints because such consumers feel unable to plan or control their outgoings, and they feel strongly that it is unfair to be charged for heat which they believe that they are not using, or when a meter appears to be malfunctioning.

112. Around one half of complaints analysed refer to unresponsive or insufficient customer service. These complaints include concerns around the hours that customer agents are available and how rapidly interruptions and other issues are addressed. This is important because consumers legitimately expect heat and hot water to be available when they need it. On some networks there are complaints about the different businesses involved in the heat network passing the responsibility for problems between themselves. Thus, resolving issues can be very time consuming for residents as they feel no one will take responsibility.

113. Consumer groups have emphasised concerns over back billing. Infrequent and unpredictable bills make financial planning difficult for consumers.

Summary

114. The BEIS survey demonstrated that heat network customers' overall satisfaction is as high as for customers not on heat networks. In addition, it showed that customers on heat networks were as likely as other customers to think that their prices were fair.

115. The BEIS evidence also demonstrated that customers on heat networks were slightly more likely to have experienced interruptions to their service than customers who are not served by heat networks. However, customers on heat

[100] Kantar report, pp19-20.

networks were as likely as those not on heat networks to consider their heating system reliable.

116. The evidence summarised above shows that customers on heat networks tend to have less control of their heating than other customers. However, again, customers on heat networks do not report being less satisfied with their level of control than those not on heat networks.

117. Both the BEIS survey and the results of our supplier questionnaire suggest that communal heating systems tend to be more reliable than district heating systems. In addition, HA and non-profit schemes appear to be more reliable than LA-operated and privately-operated schemes.

118. The research set out above (the BEIS survey, Which? qualitative analysis and our qualitative analysis) indicates that the availability of bills and other information, and access to redress are the main areas where quality is likely to differ markedly between heat networks and other forms of heating:

(a) The BEIS survey indicated that significantly fewer heat network customers received regular bills - a finding that is supported by the qualitative evidence presented above; and

(b) The BEIS survey showed that heat network customers were less likely to have been satisfied with the outcomes of their complaints, while the two sources of qualitative evidence showed that dealing with complaints and access to redress is an area where heat networks appear to perform poorly.

Appendix C: International experiences of heat networks

Case Studies on Heat Networks

119. During the information-gathering phase of the market study, we held discussions with the competition or regulatory authorities of five European countries (Sweden, Denmark, the Netherlands, Germany and Norway), in order to learn about their experiences of heat networks. Of particular interest was the approach taken by those authorities to the regulation of heat networks in their respective countries and, where relevant, their use of price caps. Based on those discussions, we have developed case studies for each of the countries, setting out:

- the context, e.g. current levels of use of heat networks, type of ownership, relevant regulatory framework,
- the challenges that the authorities reported having experienced in this sector and, where applicable, any solution or outcome adopted, and
- any future developments expected to affect the use of heat networks in that country.

120. We identified certain features which were broadly consistent across the different countries:

- heat networks were often originally set up as a result of initiatives by municipalities;
- the regulation of prices impacts on the ownership of networks, with limited levels of ownership by private companies in countries where prices are regulated;
- where regulatory price caps are in place, these are set by reference to the average cost of heat provided by, for example, domestic gas boiler or electrical heating.

Case study: Sweden

Context

121. Heat networks have been expanding in Sweden since the 1970s and are the dominant energy source for providing heat to the residential sector, with a market share of approximately 50%. Electricity is also widely used to provide

heat via the use of heat pumps. The majority (around 90%) of the heat used by networks is produced by CHP plants using renewable sources and waste, which has enabled Sweden to make massive reductions in its use of fossil fuels in recent years. There has been widespread political and social support for the use of heat networks, due both to the environmental benefits and to its efficiency: Sweden's ban on landfilling combustible and organic waste have created a strong driver for the use of waste incineration as a source of energy.

122. In terms of ownership, Sweden has a mix of local, municipality-owned networks and networks owned by larger companies. Initially, networks were introduced as a result of municipal initiatives and were managed by municipally-owned companies; many of these were subsequently acquired by large, state- or privately-owned companies, as the sector became increasingly commercial. Following those acquisitions, the large companies slowly began to raise prices, which prompted other networks to increase their prices.

123. Prior to 1996, heat network schemes were permitted to set prices so that their costs were covered. However, it was recognised that this disincentivised the introduction of efficiencies; since then, heat network operations have been carried out on commercial grounds and have not been subject to any form of price regulation.

Challenges and outcomes

124. Natural monopoly – As said, the Swedish heat network market operates on a commercial basis and is open to competition. However, due to the economies of scale inherent in building a network, it is unprofitable to have more than one heat network within a specific area, resulting in the creation of natural monopolies. In recognition of the strong position of suppliers in relation to their customers (due to the lack of an alternative supplier in any particular area, the cost of changing heating system and the absence of any stability/predictability in how prices may develop), the Swedish government commissioned a study in 2009 to analyse and propose conditions for introducing statutory third-party access to heat networks, thereby creating conditions for competition in the market. Having considered the findings of the study, the government concluded that the potential for efficiently functioning competition in the heat network market was limited and that the barriers to competition, in both the short- and long-term, were significant.

125. Significant increases in heat network prices – The Swedish Competition Authority (the Konkurrensverket) found that prices between different heat network suppliers can vary significantly, with instances of some of the large, state- or privately-owned companies charging as much as 100 % more than

the cheapest, usually municipally-owned, suppliers (although there is generally only a 5-10 % difference in average prices between the large companies and small or medium sized companies). It also found evidence of significant price rises; overall, since 1996, the price of heat networks has increased by about 62%, while the consumer price index has increased by around 24% over the same period.

126. The Swedish Energy Markets Inspectorate (the Ei) carried out some analysis of revenues and costs for heat network companies and in fact found no sign of increased unjustified revenues. The Swedish government therefore decided to allow competitive conditions to continue rather than introduce full-scale price regulation. However, in order to address public concern over price rises, an industry initiative was instigated in 2013, which aimed to improve transparency by allowing for discussions to take place between suppliers and customers regarding the principles for the fair pricing of heat network and envisaged price increases. When the Ei evaluated the scheme's impact in 2015, it concluded that it had increased predictability in price developments and built consumer confidence in heat suppliers.

127. Maximising use of surplus heat – Sweden makes use of industrial surplus heat in its heat networks and has been considering how to improve the efficiency of this resource by ensuring that the industries with heat to offer get a better price for their product. While cooperation is usually of mutual interest to the heat network company and industries offering surplus heat, agreements have sometimes been refused on unclear grounds. In order to address such instances, Sweden has now put in place a scheme which affords industries the opportunity to seek a view on their case from the Ei.

Future developments

128. Driven by the low cost of electricity in the Nordic countries, Sweden has seen an increase in the use of heat pumps in recent years, which provide a renewable source of heat to rival heat networks. The use of heat networks may also be impacted by the construction of increasingly efficient buildings with negligible levels of external heat consumption.

Case Study: Denmark

Context

129. Following the oil crisis in the 1970s, Denmark sought to reduce its reliance on imported oil by increasing its use of heat networks. At that time, heat networks already provided heat to around 30% of homes and the decision was taken

that CHP systems should be expanded to cities across the country. Heat networks are now the dominant source of heat for around 63% of domestic properties in Denmark, with domestic gas boilers holding a much smaller market share. Almost half of the heat networks in Denmark are fuelled by renewables, resulting in a large reduction in the country's use of fossil fuels. The majority of heat suppliers in Denmark are companies that are either municipally-owned or co-operatives; since suppliers are only permitted to price so as to cover their costs and any surplus profits have to be paid back to customers via lower future prices, the number of privately-owned heat suppliers in Denmark is decreasing. Out of 600-700 networks in Denmark, there are 430 operators, indicating that most suppliers only operate one network (and are therefore likely to be municipally-owned/co-operatives, not private companies).

130. In terms of regulatory framework, the heat network sector is subject to specific regulation in relation to planning (which is managed by the Danish Energy Authority) and to pricing (which is overseen by the Danish Energy Regulatory Authority). A local authority may only approve a planning application for heat if it concludes that, having regard to socio-economic and environmental factors, a heat network is the best system for the area; most weight is given to economic considerations, specifically whether heat network is more cost-effective than individual heating (i.e. an individual gas boiler system) for the particular development.

131. Heat networks in Denmark are regulated on a not-for-profit basis: suppliers are not allowed to charge consumers more than the costs of providing heat. This applies to all suppliers, even commercial companies, although there are exceptions: energy generated by biomass-based plant can be sold at a profit, in order to incentivise the use of renewables, but the level of profit is capped. There is also a possibility of profit for waste heat, although again this is subject to a cap. Heat suppliers must report their prices to the Danish Energy Regulatory Authority and there are rules around the relevant accounting treatments. This information is also disclosed publicly so that there is complete transparency. Suppliers are required to use the cheapest source of heat available to their networks. There are different cost bases across different heat networks, which can lead to significant variations in prices, depending on the density of population (lower prices in areas of high density), the fuel used and the means of generation. There is currently no benchmarking between companies.

Challenges and outcomes

132. Meeting the cost of installing a heat network – Consumers in Denmark are obliged to pay for their local system if they live in an area with a heat network, even if they don't use it, as with other public services e.g. sewers. Heat supply contracts are subject to a six-month limit: however, before changing supplier, customers are required to pay off their part of the investment in the initial heat network. This does not apply to property sales, where there is no obligation on the future owner to pay.

133. Ensuring that 'not for profit' pricing is enforced – Suppliers have to notify prices to the regulatory authority; if the authority considers that the supplier has exceeded its true costs and there is a surplus, this must be paid back via following year's prices. The authority does not tell suppliers what the price should be, although, under the new regulatory framework, it can do so if it considers that the surplus has not been repaid.

134. Incentivising efficiency – In recognition of the disincentivising effect on efficiency of 'not for profit' price regulation, since all costs are covered, Denmark is developing a new regulatory framework which provides for benchmarking across companies; due to differences in the size and scale of networks, it may be necessary to divide the industry into smaller groups on basis of size.

135. Protecting consumers – Denmark has historically balanced the need to protect consumers against the need to promote heat networks as a response to the oil crisis. However, consumers' interests are protected by the 'not for profit' regulatory regime, which guards against unjustified price rises for customers, and by the fact that, before changing supplier, customers have to pay off their part of the investment in the initial heat network, so protecting other customers from a possible increase in their prices. As the majority of heat suppliers are publicly owned, it is considered that customers' interests are sufficiently protected by ownership of their own schemes and that there is a limited need for licensing and monitoring by the Danish government. This is reinforced by a requirement that heating companies must offer customers 'first refusal' on purchasing a heat network if the company wants to divest itself of that network. Public ownership also creates less incentive for companies to install cheap heating systems and means that greater regard is given to the whole life costs of networks.

Future developments

136. The new regulatory framework will take effect from 2021 and will ensure that prices reflect the costs of running a network efficiently. More generally, CHP generation has decreased in recent years, as CHP plants are encountering challenging economic conditions due to the availability of cheap Nordic electricity.

Case Study: Netherlands

Context

137. Due to the Netherlands' large reserves of natural gas, approximately 90% of homes receive their heat via domestic gas boilers. Heat networks are in very limited use, with less than 5% of homes receiving heat this way. However, the use of heat networks is gradually becoming more widespread, due to political support for their environmental benefits: 90% of heat generated in 2013 came from direct renewable sources and recycled heat. Most networks in the Netherlands are operated by large, privately-owned companies, although they may have been started as an initiative by a municipality (the municipality may continue to hold a stake in the network). The sector is characterised by high levels of vertical integration, with companies involved in supply and distribution; the four main heat network firms own the majority of the transport and distribution infrastructure, often also operating their own CHP plants.

138. The Dutch are developing a new Heat Act which is intended to address issues with the existing regulatory framework: it is due to be in force, in part, by July 2018, although new tariffs (e.g. for connection fees, which are to become fully regulated, and metering) will be introduced in January 2020.

139. During the period that the legislation was under debate, a voluntary tariff for heat networks was put in place by the larger companies, covering a substantial part of the market. The tariff was based on what a comparable customer would pay for individual gas boiler. Using gas as a counterfactual fails to reflect the fact that there is a lack of gas availability for some properties, however, there is a general acceptance that the customers in those properties should not have to pay more than those living in properties with gas availability. Under the new Heat Act, all suppliers will be subject to price regulation on the same basis as the voluntary tariff, although lessors that supply heat to lessees – in most cases, housing associations – will not be covered, as the cost of heat is subject to separate regulation in the context of rent.

Challenges and outcomes

140. Issues around developing regulation – In developing the new Heat Act, the Dutch reported that numerous considerations had informed their proposals for the regulation of networks, such as the need to take a cautious approach in order to avoid harming potential investment; the difficulties inherent in designing regulation which is fair for each company involved, given that every system is technically and economically different (e.g. differences in location of provision, differences between gas and electricity, etc.); the issues involved in regulating for legacy systems. In particular, in relation to price regulation, there were issues around defining what qualified as a ‘comparable’ gas consumer for properties where gas was not available.

141. In addition, for some consumers, basing their heat network tariff on what a comparable customer would pay for gas would result in higher prices than would otherwise apply, as suppliers will naturally set their prices close to the maximum. Meanwhile, for suppliers, should gas prices drop, the price they could charge would also drop despite the fact that they would not be making any cost-savings as a result of the fall in gas prices.

142. Research into the prices that companies are charging for heat is carried out on a biennial basis. Recent analysis has shown that, following the introduction of the voluntary tariff, all suppliers charge close to the maximum price but that profits are generally quite low. Although it is not clear that price regulation always benefits consumers, and there may be cases where prices were lower before the tariff was introduced, suppliers have been stopped from imposing very high charges as a monopolistic provider, and there have been improvements in terms of transparency around pricing.

143. Network assets located on customer’s property – In some systems, the installation of assets which form part of the system is required behind the connection of the consumer, for example, installation of a heat interface unit, where the heat is transferred from the network to the in-house heating system (and hot water system) through a heat exchanger. Where assets which form part of the network are located in the customer’s property, these are rented from the supplier but, despite a requirement in the current Heat Act that these should only be based on ‘reasonable costs’, there have been complaints about high rental costs. Under new Heat Act, the Dutch Authority for Consumers and Markets will determine the maximum price that heat suppliers can charge per year for this installation.

Future developments

144. As stated, new tariffs will be introduced in January 2020, which will result in full price-regulation. Disconnection fees are still under consideration; the aim is to set one price based on an average of the cost to suppliers of carrying out a disconnection, but significant research is still required before a truly representative cost can be determined.

Case Study: Germany

Context

145. The dominant share of domestic heating in Germany is provided by individual gas boilers; heat networks supply heat to approximately 14% of residential properties. The use of fossil fuels in heat networks remains high, but the use of renewables is increasing, with around 13% of heat being generated from renewable sources.

146. In 2009, the German Competition Authority (the Bundeskartellamt) commenced a major sector inquiry into heat networks, to review how the lack of competition between district heating suppliers (arising from the naturally monopolistic characteristics of heat networks) impacts on competitive behaviour and market outcomes in the sector. The inquiry took 2-3 years to complete and looked at 70-75 suppliers and over 1000 network areas; it focused on the supply of heat to private domestic customers and small businesses, but excluded bigger commercial customers. The inquiry concluded that heat networks constitute a different product market from general heating: although different heating types can be substituted at the time of the initial decision as to the form of heating to be used in a development, once a decision has been taken as to fuel type, there is no longer scope for substitution. The inquiry revealed only a few cases of excessive pricing which required further action, but identified substantial variations in the prices charged for heat.

147. Suppliers in the German heat networks sector include both large, commercial companies (which are often vertically-integrated, both generating and distributing heat for a network) and municipally-owned utilities. Where the supplier is owned by a municipality, prices may be influenced both by economic factors and by political considerations.

148. Following the conclusion of the inquiry, regulation of the sector was considered. However, regulating the gas and electricity sector in Germany had proved technically complex and costly, and had variable results. Instead

of opting for full regulation of the sector, the government decided instead that competition would be better promoted by holding regular tenders for heat networks. Some regulation of heat networks had been in place since the 1980s/90s, in the form of general terms of service which every heat network supplier is required to follow when drawing up a contract. The maximum contract length is ten years and, thereafter, customers must enter into a new contract. While landlords may have some power to renegotiate contract terms, individual customers are very unlikely to have any power to do so and there is generally no scope to switch to a different supplier. Switching to a different form of supply (e.g. gas boiler) might be possible but is likely to be both difficult and expensive. There may also be contracts where suppliers own the assets and the network itself, but have to contract with a municipality to gain a right of way over municipality-owned land.

149. There is no price regulation of the German heat networks sector. The sector inquiry looked at pricing, comparing average price per kilowatt hour (kWh) as well as looking at total revenue earned. Networks were categorised by size/length in order to facilitate comparison and a broad range in prices was identified. Some correlation was noted between kWh price and size of network, with larger heat networks (defined as those of 100km+ length) in cities such as Dresden and Hamburg having cheaper per kWh prices due to greater efficiency and higher population density. Smaller networks (2-3km in length) had the higher kWh prices. Prices tend to be based on a cost-escalator model, where prices increase annually rather than on the basis of an increase in the cost of fuel. Cost-escalation clauses are common due to the length of contracts but can lead to higher prices for customers.

Challenges and outcomes

150. High prices – In March 2013, the Bundeskartellamt initiated enforcement action against the networks with the highest prices as compared to others of a similar size/length. Each of the companies claimed that their higher prices could be justified by differences between their systems and those of the similarly-sized companies. While the Bundeskartellamt accepted that there were many features which differed by network, it had to consider whether those differences were justified. In 2015, it closed its investigation into the municipal utility in Leipzig following a decision to accept commitments; the utility, which was 100% owned by the municipality, agreed to change its pricing system, effectively lowering prices and resulting in price reductions for the following five years as compensation against possible excessive pricing in the past. The case demonstrated that municipality-owned companies do not necessarily have customers' best interests at heart. Another of the

investigations was resolved by settlement in 2016, by which a supplier agreed to reimburse customers for possible past excessive pricing by means of credits on customers' accounts over a period of two years.

151. Need for greater transparency – Another outcome of the sector inquiry was a recommendation that suppliers should publish prices; as a result, increasing numbers of suppliers began to publish their tariffs on their websites. However, due to variations in the pricing structures used by different suppliers, the Bundeskartellamt report that it is still difficult to compare tariffs, despite the increase in transparency; in any event, if customers have no choice as to their supplier, transparency is of only limited value.

Future Developments

152. Expansion of urban areas is expected to lead to the extension of existing networks in German cities, with an anticipated increase of 25% in the numbers of customers on heat networks by 2025. It is hoped that this will lead to an increase in the use of renewables to generate heat and a reduction in Germany's reliance on fossil fuels.

Case Study: Norway

Context

153. In Norway, heat networks currently have only a 3% share (approximately) of the domestic heat market. There is, however, a strong political focus on stimulating the use of heat networks, attributable at least in part to their environmental benefits: as much as 90% of the heat used in networks is generated from renewable energy sources. The imposition of a tax on landfillable waste creates a further incentive to generate heat via waste incineration.

154. The focus on heat networks has driven a push for the mandatory connection of new networks to existing systems in the market to stimulate their use. Currently, however, heat networks only have a minor share of the market for domestic heating, with electricity remaining the dominant source of heat. The Norwegian authorities have identified a need for a market study into the heat networks sector. In terms of suppliers, Norwegian heat networks are generally owned by municipalities.

155. In terms of regulation of the Norwegian heat networks sector, companies are required to obtain a licence before they establish a network. The Planning and Building Act creates a mandatory connection obligation, requiring new

dwellings to connect to heat networks in areas where networks exist, unless there are alternatives which are better for the environment. The purpose of the obligation is to ensure better utilisation of existing networks (although building owners are not obliged to use the network as a heating source even if they are connected to it). Mandatory connection also gives the owner of a network a monopoly position within the relevant area.

156. There are also regulations requiring that a certain amount of heating in a new building must be supplied by heating that is more environmentally friendly. Compulsory energy labelling was introduced for all buildings in 2010, with the aim of promoting energy efficiency and information on energy use in buildings. The scheme ensures that consumers are informed of the energy consumption and environmental credentials of a property before they decide to purchase or rent.

157. Pricing is regulated under the Energy Act for mandatory connections on the basis of benchmark pricing, with the price for heat capped according to electricity prices.

Challenges and outcomes

158. Barriers to entry – Mandatory connection is in place in order to achieve the scale required for heat networks. Given the high level of sunk cost involved in building to a heat network, the mandatory connection of new properties increases the viability of investment. However, while mandatory connection is effective and predictable, it can distort competition in the market by increasing the cost to the builder and the cost of housing in general, or by limiting the opportunity for the introduction or innovation of other technologies, e.g. solar power. It can also distort competition between building projects in different municipalities, where one area is inclined to introduce mandatory connection and another is not.

159. Implementation of price regulation – The Norwegians reported that top-down regulation with a benchmark price secures investment and provides an incentive for suppliers to run heat networks efficiently.

160. Transparency – Under compulsory energy labelling, both sellers and landlords are required to advertise the energy label of their property when selling the property or putting it up for rent. Although this requirement has the potential to increase consumer awareness of the heating costs of a property, a recent survey suggested that consumers do not pay much attention to the energy label when deciding to buy or rent a property in Norway and that therefore the effect of labelling is marginal in the decision whether to buy or rent a property

or not (although it may be that heating costs are low in Norway compared with the overall price of housing).

Future developments

161. Some consideration has been given to the possibility of removing licences, which would require new regulation and may also affect price regulation. The Norwegians also anticipate a shift over the next 15-20 years towards different types of waste management, rather than waste incineration, which might impact on the fuel sources used for generation in relation to heat networks.

Appendix D: Planning

162. As described in sections 2 and 4 of the main report, in some areas of the country the planning regime can be a key driver of the development of new heat networks where local or development plans set energy and carbon reduction requirements, over and above the minimum standards set out in building regulations.

What is planning?

163. Government describes planning as: ‘Planning ensures that the right development happens in the right place at the right time, benefitting communities and the economy. It plays a critical role in identifying what development is needed and where, what areas need to be protected or enhanced and in assessing whether proposed development is suitable.’[101]

164. There are three tiers to planning: National enabling legislation, local plans which set out ambition for a particular area and applications for permission to build a particular development. The government’s online planning resource sets out that, ‘Most new buildings or major changes to existing buildings or to the local environment need consent - known as planning permission. Local planning authority is responsible for deciding whether a development, anything from an extension on a house to a new shopping centre, should go ahead.’[102]

Legislation and policy

165. The approach to planning in the UK is devolved and governed by different primary legislation in each country. In England planning legislation is encoded in the National Planning Policy Framework, a consultation on revisions to which closed on 10 May 2018. The Welsh Government concluded a consultation on Planning Policy Wales on 18 May 2018. And in Scotland Planning Policy is encoded in the National Planning Framework 3. The Scottish Government also concluded a consultation on 20 February 2018 on local heat and energy efficiency strategies, and regulation of district and communal heating, which includes planning recommendations.

[101] Plain English guide to the Planning System page 4.
[102] Planning Portal, a joint venture between the Ministry of Housing, Communities & Local Government and TerraQuest Ltd to provide online planning information.

Implementing regulations – local or development plans

166. Planning is implemented at a local level by local authorities. Local authorities must produce a local plan (Local Plan in England, Local Development Plan in Scotland and Wales) which must align with national legislation and set out specific priorities for the locality; what kind of development they would like and where.

167. In England the Local Plan may set out that all development will be subject to a Community Infrastructure Levy to develop local infrastructure to support the development. The Local Plan will set a price per square meter that developers must pay.[103]

168. In England, planning obligations, to make the development more acceptable, can be agreed between the local authority and property developer. These agreements would be set out in a bespoke section 106 (of the Town and Country Planning Act) agreement. This may include financial contributions or gifts in kind (such as land or infrastructure). It may also include future obligations – such as an agreement to connect to a heat network if one is built in the future. These future obligations are the only way on which planning has an impact once the building is occupied.[104]

Property developers seeking planning permission: planning process

169. Local planning applications are determined by local authorities in line with their local plans[105].

170. Where planning permission is required,[106] a public or private sector developer will apply to the local planning authority for permission to develop a site (this might be a single building or a large multi-phase site). This application must demonstrate that the development will comply with the requirements set out in the local plan.

171. Prior to submitting an application, the property developer will have undertaken an assessment to identify whether the venture is financially viable. A site is viable where the value generated by the development exceeds the costs of

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[103] Community Infrastructure Levy.
[104] Conditions and obligations.
[105] Planning process set out in Annex C page 20 Plain English guide to the Planning System and Planning Portal.
[106] Some development is defined as 'permitted development' and does not require planning permission.

developing it[107] in accordance with all relevant policies in the local plan. The viability test looks at the costs of building the development and as such it does not consider lifetime costs (ie any operating or maintenance costs associated with the properties) and does not consider customer heat price.

172. A specific calculation methodology for assessing whether the whole development is viable is not set at a national level (although the NPPF provides guidance). However in England for example, there is guidance on the components of this calculation. In simplified terms developers' returns on top of the land value before development and construction costs are capped; 20% of Gross Development Value[108] (GDV) (6% GDV for affordable housing). The proposals in England's recent planning consultation sought views on improving the viability framework.[109]

173. Where a developer believes requirements in the local plan are affecting viability this will be the subject of pre-application discussion between the developer and the local authority and/or set out for consideration as part of the planning application.

Implications of planning for heat networks

174. A small number of local authorities in the UK, concentrated London and Scotland due to overarching regional policies, have chosen to include energy and carbon reduction requirements, over and above the minimum standards set out in building regulations, [110] in their local/development plans. It is in these areas that planning is an important driver for installing heat networks.

175. When assessing how to meet carbon and energy planning requirements as cost effectively as possible developers will need to consider all sources of energy use in their properties which includes heating and hot water provision. An appraisal of heating and hot water options is likely to compare individual heating systems with communal (for multi-occupancy buildings) and district heating (either connecting to an existing district heating scheme if there is one or building a new network). This work will be wrapped up into the overall viability assessment for the whole development.

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107 Viability guidance for England and Scottish Government A Guide to Development Viability.
108 GDV is an assessment of the value of development. For residential development, this may be total sales and/or capitalised net rental income from developments. Draft Planning Practice Guidance page 7.
109 Page 10 England's Draft Planning Practice Guidance part of the National Planning Policy Framework consultation closed 10 May 2018. A similar approach is used in Scotland and Wales.
110 The Building Regulations 2010 cover the construction and extension of buildings. The Clean Growth Strategy sets out the Government's plans for consulting on energy performance standards in building regulations later this year.

176. For some development sites a heat network will be the most cost-effective way of delivering the required carbon savings, but may not be the most cost-effective option for the consumer compared to alternative sources of heat. The cost of delivering these carbon savings, however, may mean that the end user is not provided with the cheapest source of heating and hot water provision. An alternative form of heat supply, for example an individual gas boiler, could be cheaper but may not be able to meet the carbon and energy planning requirements.

177. These costs, additional to the alternative heating method, are likely to be borne by the customers on the heat network, through some combination of higher property prices and higher heating bills, whilst the benefits of the carbon savings accrue to society as a whole.

Permission to build a heat network

178. Any heat network, irrespective of whether planning was a trigger for the properties it serves, will need planning permission itself and will need to go through the planning process outlined above. Additional permissions, such as wayleaves, easements and property rights, are also required for putting pipes in the ground.

Regional policies

Regional policies London

179. For major developments there is an explicit requirement in the London Plan to consider heat networks[111] (differentiated from a general carbon requirement), see energy system hierarchy below. London boroughs are responsible for preparing local plans for their own areas, but must ensure that they are in 'general conformity' with the Mayor's London Plan[112].

180. The Greater London Authority (GLA) considers the issue of ongoing costs to the consumer in its heat network guidance, it states, 'the heat network must be price competitive compared to alternative heating methods (eg individual gas boilers)' for end customers and, 'most local authorities will require [planning] applications to be accompanied by a feasibility and viability assessment which will be scrutinised by their officers to determine whether connection is reasonably practicable'.[113] The London Heat Network Manual is

[111] Decentralised energy in development proposals
[112] Local plans
[113] See pages 16 and 100 of the London Heat Network Manual.

guidance only and London Boroughs can choose whether to adopt this and require developers to meet the standards it sets out.

London Plan 2016: Policy5.6 Decentralised energy in development proposals

a. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

b. Major development proposals should select energy systems in accordance with the following hierarchy:
   1. Connection to existing heating or cooling networks;
   2. Site wide CHP network;
   3. Communal heating and cooling;

c. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Scotland

181. In Scotland, the Scottish Planning Policy sets out national planning policies, one of which is carbon reduction. The Policy states that local development plans should support the development of heat networks in as many locations as possible, even where they are initially reliant on carbon based fuels if there is potential to convert them to run on renewable or low carbon sources of heat in the future. Where a district network exists or is planned, policies may include a requirement for new development to include infrastructure for connection, providing the option to use heat from the network. [114]

Scottish Planning Policy

159. Local development plans should support the development of heat networks in as many locations as possible, even where they are initially reliant on carbon-based fuels if there is potential to convert them to run on renewable or low carbon sources of heat in the future. Local development plans should identify where heat networks, heat storage and energy centres exist or would be appropriate and include policies to support their implementation. Policies should support safeguarding of piperuns within developments for later connection and pipework to the curtilage of development. Policies should also give consideration to the provision of energy centres within new development. Where a district network exists, or is planned, or in areas identified as appropriate for district heating, policies may include a requirement for new development to include infrastructure for connection, providing the option to use heat from the network.

[114] Scottish Planning Policy.

Wales

182. In Wales, the Planning Policy Wales document states that particular attention should be given to opportunities for minimising carbon emissions associated with the heating, cooling and power systems for new developments.[115] This can include utilising existing or proposed local and low and zero carbon energy supply systems (including district heating systems), encouraging the development of new opportunities to supply proposed and existing developments and maximising opportunities to co-locate potential heat customers and suppliers. The draft Planning Policy Wales[116] includes guidance and requirements on an energy hierarchy, renewable energy targets, recognition of the importance of energy storage, identification of opportunities for strategic sites that can achieve higher standards than Building Regulations and guidance on whole life costings. Again, these requirements are enacted through local development plans.

[115] Planning Policy Wales, Edition 9, November 2016, paragraph 4.12.7.
[116] Draft Planning Policy Wales.

Appendix E: Technical Standards

Introduction

183. This appendix sets out the current levers driving technical standards for heat networks, possible future changes and views the CMA has gathered from stakeholders.

Stakeholder views

184. During our engagement with stakeholders, we were informed that one of the major reasons that customers experienced poor outcomes on some networks was due to the lack of measurable and enforceable standards for the initiation, design, build, commissioning and operation of heat networks.[117]

185. Work funded by BEIS to monitor and analyse data from operating heat networks has identified that significant cost reductions could be achieved through improved design, build, commissioning and operation[118].

186. One common area for improvement illustrated in the FairHeat report is optimal sizing of heat sources and pipes. When designing a non-networked heating and hot water system for an individual property, the heat source (commonly a gas boiler) and pipes must be sized for the maximum heat demand. On a network serving multiple customers, however, the peak heat demand of each customer does not occur simultaneously. Consequently, the total heat network capacity can be smaller than the cumulative total of the individual peak demands. Reducing the capacity of the heat source and pipes to an appropriate size will not only reduce initial capital expenditure, it should also help the network run more efficiently thereby reducing operating costs, without compromising the quality of the service received by customers.[119]

187. Some stakeholders told the CMA that current practices of oversizing result from design engineers' lack of expertise in the operation of networks (particularly those with CHP), as well as a lack of available heat network performance data. They suggested that this lack of data can lead to property developers demanding inappropriate requirements when specifying the

[117] For instance, two housing associations told us that some of the poor outcomes on their old schemes were attributable to the poor design and build due to the lack of established building standards. Two other significant heat network suppliers also confirmed this and recommended the publication of measurable and enforceable standards in this industry.
[118] FairHeat Optimising Heat Networks 2017.
[119] Engineers refer to 'diversity curves' graphs which show the percentage reduction from cumulative total of the individual demand to inform optimal sizing. Up to a point, larger networks with more customers have a greater reduction in capacity.

network, ie utilising a non-networked approach to capacity which leads to oversized heat networks, which design engineers do not challenge due to concerns regarding their professional indemnity insurance.

Current standards

Building regulations

188. Regulations: The English, Welsh and Scottish Building Regulations set out the standards to which buildings must be constructed. They are enforceable by local building control (or local authority buildings standards service in Scotland).

189. Energy requirements: Part L of the Approved Documents in England and Wales, Conservation of fuel and power,[120] sets the standards for the energy performance of new and existing domestic buildings (Part 6 of the Technical Handbook in Scotland sets out energy requirements). There are plans to consult on Part L of England's Building Regulations[121] and Scottish Building Regulations later in 2018.[122]

190. Compliance guides: Compliance with these standards can be demonstrated by following Domestic Building Services Compliance Guide (published in 2013 in England and Wales[123] and 2015 in Scotland[124]). Section 6 of both documents sets out minimum standards for the functionality and performance of communal heating supplying 15 or more dwellings and district heating. It sets requirements on controls, meters, flow rates, temperature and insulation of pipes.

191. Stakeholders have indicated to the CMA that the compliance guides alone do not provide sufficient guidance to design an efficient heat network. We are interested in views on whether the Community Heating sections of the Building Services Compliance Guides need to be improved and whether they are adequately cross referenced with CP1 the Heat Networks Code of Practice (discussed further below).

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[120] Conservation of fuel and power: Approved Document L.
[121] Page 12 of the Clean Growth Strategy states: 'Following the outcome of the independent review of Building Regulations and fire safety, and subject to its conclusions, we intend to consult on improving the energy efficiency of new and existing commercial buildings'.
[122] See page 95 Climate Change Plan Third Report 2018 A further review of energy standards will commence in 2018 and will investigate a number of measures that offer the potential for further abatement from new homes and where work is undertaken in existing homes.
[123] England's Domestic Building Services Compliance Guide.
[124] Scotland's Domestic Building Services Compliance Guide.

192. Standard Assessment Procedure: SAP is the methodology used by the Government to assess and compare the energy and environmental performance of dwellings across the UK; it is not devolved. For new dwellings SAP demonstrates compliance with Building Regulations Part L. For existing dwellings reduced data SAP (RdSAP) is the simplified methodology used to produce Energy Performance Certificates (EPCs), which are required at point of sale or rental[125]. SAP is not used to design dwellings.

193. Government ran a consultation on SAP[126] in 2016 one aspect of which focussed on heat network heat losses[127] ie is the amount of heat delivered to customers less than was generated by the heat source due to heat dissipating through the pipe infrastructure? Government published a response in 2017[128] but further technical work is underway and proposals will be consulted on again following the Independent Review of Building Regulations and Fire Safety (Hackett review) and subsequent consultation on England's Building Regulations.

194. The proposals on treatment of heat networks in SAP recommend that the default value for losses reflect values found in inefficient networks. Where there is evidence that the CIBSE ADE Heat Networks Code of Practice CP1 (see below) has been followed a better default heat loss value will be available. It will also be possible to enter a heat loss figure specific to the network, where this can be evidenced, incentivising efficient networks.

195. EPCs consider energy prices in two ways. Firstly, the A-G energy performance rating, calculated using SAP, includes consideration of how much it costs to run the building. Secondly the EPC also provides estimated annual energy costs. These figures multiply the building energy requirement by average fuel-specific prices set out in the SAP methodology. This calculation does not, therefore, reflect the real-life tariffs for a specific heat network. Government will continue to gather views on how to improve this, including through the planned Building Regulations and SAP consultation later this year.

196. We are interested in views as to whether building control could be an effective mechanism by which to make some technical heat network standards enforceable eg through the communal heating section of the Building Regulations compliance guide and through SAP. Note that some existing

125 A guide to energy performance certificates for the marketing, sale and let of dwellings, MHCLG.
126 BEIS SAP consultation.
127 BRE consultation on heat network losses.
128 BEIS SAP consultation response.

buildings may be able to connect to a heat network without requiring approval from building control.

Heat Networks technical standards

Heat networks code of practice

197. As described in section 2 and 4 of the main report, the ADE (Association for Decentralised Energy) and CIBSE (Chartered Institution of Building Services Engineers) published technical guidance for communal and district heating networks, CP1, in 2015. The code is complementary to Building Regulations and provides more detail on technical considerations with respect to the design, build and operation of both communal and district heating schemes.

198. Networks built before 2015 had no comprehensive heat networks specific guidance to follow. District heating networks can take a long time to develop (up to 5 years) and so those networks that were already under development would only have been able to utilise CP1 partway through the design process. Further to this, the industry code is voluntary and therefore it is not enforceable[129] across all new or existing networks.

199. We have engaged with housing associations and private property developers who have worked in partnership with engineering consultants[130] to write supplemental guidance to accompany CP1. This client-specific guidance identifies which parts of CP1 are relevant and sets installation and performance standards for the district and communal heating schemes they manage. This has provided useful insights into operating heat networks and could indicate areas in which CP1 could be strengthened for all networks.

200. Industry has identified there is room to improve the guidance and work to update CP1 has just begun and aims to conclude in the late 2018. This revision will tighten the areas in which CP1 sets standards and will structure the guide in such a way that compliance can be checked, which will improve its measurability. CIBSE are currently seeking views on how CP1 can be improved.[131]

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[129] Utilisation of CP1 is a requirement of BEIS Heat Networks Investment Project funding.
[130] For example, FairHeat.
[131] CIBSE current consultations Heat Networks Code of Practice for the UK.

London Heat Networks Manual

201. The GLA's London Heat Networks Manual sets out design principles, standards and the key considerations with respect to installation and construction of district heat networks, with a focus on facilitating future interconnection.[132] The manual is a guide and not enforceable by the GLA, but some London boroughs stipulate that public and private must follow the manual as a condition of planning permission.

Other sources of technical standards

202. Some technologies used on heat networks and to supply single buildings have technical standards which drive quality. These include the below.

203. CHPQA: Combined Heat and Power Quality Assurance scheme, which assessed annually, whether CHP is operating as 'good quality'; meeting the CHPQA standards on energy efficiency and environmental performance. A CHPQA certificate is a prerequisite for accessing incentives and subsidies such as Renewable Obligation Certificates, Renewable Heat Incentive, Carbon Price Floor (heat) relief, Climate Change Levy exemption (in respect of electricity directly supplied), Enhanced Capital Allowances and preferential Business Rates.

204. Renewable Heat Incentive: Assets in receipt of RHI payments must operate to the standards set out in Ofgem's eligible technology guidance. This can be audited.

205. Heat meters: The heat network metering and billing regulations specify that meters installed under these regulations must comply with the standards in the Measuring Instruments Directive.

206. CP2 and CP3: CIBSE have published two voluntary codes of practice for heat pumps.

207. BESA HIU: Building Engineering Services Association UK test standard for Heat Interface Units does not provide certification but allows testing results of different HIU models to be compared.

[132] London Heat Network Manual.

Future quality assurance scheme

208. ADE launched a Task Force in 2017; an industry initiative to develop proposals to, ‘deliver a subsidy free heat network market with strong protections for consumers’. One of the recommendations in the concluding report[133] was that a quality assurance scheme was critical to market development. The report indicated that such a scheme should aim to ensure that participants are held accountable for build quality and network performance.

209. This work is in its early stages but the intention is to seek stakeholder views on the shape of the scheme. Discussions with industry have highlighted that it is challenging to consider technical issues in isolation and the extent to which a quality assurance scheme should look at commercial and financial aspects of a network alongside the technical, and require contractual evidence that standards will be met, is to be explored. Such a scheme would go beyond checking compliance with CP1 and could also include expert/independent review in order to provide quality assurance accreditation at each stage; ie design, build/commissioning and periodic review during operation. Consideration will be given to whether operating district heating networks could be retrospectively accredited. A scheme such as this would be measurable in terms of compliance but would only be enforceable for its voluntary participants.

[133] Shared warmth: a heat network market that benefits customers, investors and the environment, ADE industry heat network task force report, 30 January 2018, page 35.