HEAT AND THE CITY

12/01/18

Comments on the Competition and Markets Authority's "Heat Networks Market Study – Statement of Scope"

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1 General comments

In the statement of scope (SoS) the CMA notes that conducting a market study under the Enterprise Act 2002 should be for the following purposes

- To consider the extent to which a matter in relation to the acquisition or supply of goods or services of one or more than one description in the UK has or may have effects adverse to the interests of consumers; and
- To assess the extent to which steps can and should be taken to remedy, mitigate or prevent any such adverse effects.

Under these definitions (and the content of the SoS) it appears the relevant 'interests of consumers' refers to district heating service standards, district heating costs, and consumer protections available to domestic users of district heating. However, the policy reasons for development of district heating extend to wider issues of sustainability, particularly the aggregate costs across society of decarbonising heat. When considering remedies, the CMA should make reference to potential consequences for these wider issues. In particular, to the extent that district heating is the most (socially) cost effective decarbonisation solution in a given area, remedies whose effect is to restrict development of district heating potentially impose costs on society (either future consumers or taxpayers). Where interventions promote competition, the efficiency savings generated by competitive pressure should be set against additional costs arising from competition. District heating infrastructure has high capital costs and exhibits scale economies, meaning user costs are minimised when concentrated groups of users join schemes in a coordinated fashion, and when an operator is sufficiently confident of ongoing demand to recover upfront costs slowly. Retail competition thus has more potential for detrimental impacts on consumer prices for district heating than other low carbon heat options.

1.1 Costs of heat decarbonisation

Techno-economic analyses of heat decarbonisation imply the main alternatives to natural gas (hydrogen, individual heat pumps and district heating supplying low carbon heat) all have higher costs than continued use of gas (Energy Research Partnership, 2017). However, higher costs arise in different places across heat supply systems. For hydrogen the cost increment is concentrated in the energy supplied (i.e. an ongoing cost), for individual heat pumps in the equipment inside buildings (i.e. an upfront cost related to individual buildings), and for district heating in the infrastructure (i.e. an upfront cost related to groups of buildings) (MacLean et al., 2016). Higher costs for low carbon heat in part reflect their resource costs (e.g. the energy penalty involved in converting methane to hydrogen and capturing and storing CO_2 (Northern Gas Networks et al., 2016)), but also the absence of a carbon price on gas (Helm, 2017). Indeed, Advani et al. (2013) analyse the reduced 5% VAT rate on domestic gas as an implicit carbon *subsidy*.

If the transition to low carbon heat is also a transition to more expensive heat, questions of fair treatment and equity become more complex (Frerk and MacLean, 2017). This has consequences for how the CMA should frame the question of 'excessive' pricing. The SoS (§74) implies 'excessiveness' would be judged by reference to mainstream (usually gas) heating (while factoring in non-bill costs/savings). However, the cost of district heating to a household may be higher than a gas counterfactual either because of failures in the delivery of district heating or because low carbon heating is more expensive in general. The former finding would indicate a need for intervention in the district heating market. The latter would raise questions about how the transition to low carbon heat should be paid for, in particular whether the additional costs of decarbonisation should be carried by consumers of low carbon heat or socialised (e.g. either through energy bills or taxation).

The cost structure of district heating (high fixed costs, low variable costs) has two broad consequences for their economics, both of which are relevant to the impact competition may have on prices.

- First, the more heat network infrastructure is shared across heat users, the lower the cost per user. This underpins the three elements of a user base that are regarded as important to making heat networks economically viable: heat density, heat diversity (i.e. users who demand heat at different times), and anchor loads whose commitment stabilises a network's initial financial performance while further connections to smaller users are made (King and Shaw, 2010). To the extent that competition results in fewer users (across domestic and non-domestic) using infrastructure in a given area, the average cost per user (or per kWh) will, *ceteris paribus*, be higher.
- Second, the greater significance of capital costs to district heating business models mean annual user costs are sensitive to the period over which

infrastructure costs are recovered and the rate of return the district heating business model achieves (Hawkey et al., 2016). The confidence a heat network operator has in the long-term stability of heat demand is thus an important influence on costs to users. For example, with a 25 year amortisation period, the revenue required to cover infrastructure and returns increases by around 10% for every percentage point increase in internal rate of return. The competitiveness of district heating is therefore highly sensitive to required returns, which themselves are sensitive to perceived risk. The effect was illustrated starkly by the UK's "National comprehensive assessment of the potential for combined heat and power and district heating" (Ricardo Energy and Environment, 2015)[1]. De-risking heat network business models was calculated to increase the scope for district heating to have lower socioeconomic cost (than natural gas or heat pumps) from 3% to 39% of total UK heat demand.

Addressing consumer detriment where it is found *by promoting switching away from district heating* has the potential to push the costs of district heating up more significantly than for other low carbon options, and potentially to a degree that outweighs the cost savings promoted by competition. By increasing the cost of one approach to heat decarbonisation, the overall cost of decarbonisation would also be impacted. Promotion of competition at the end-user level should thus be considered just one approach to alleviating consumer detriment and its broader costs should be accounted for. Other routes, such as socialising the costs of decarbonisation, promoting transparency in commercial models and forms of competition that do not exacerbate the risk of users leaving a network, may strike a better balance between protecting consumers and securing heat decarbonisation.

1.2 Approach to data collection

As shared infrastructure, it is difficult to understand the costs faced by domestic users without also considering the wider market. As such, the CMA's focus on detriment to domestic users should not limit the scope of its research into the cost structure and value chain for heat networks to the relationship between domestic users and their heat network. In particular, the UK has to date struggled to develop heat networks with the economies of scale seen in other European countries (Hawkey et al., 2016). Judgements about 'the cost' of district heating should therefore consider the whole heat market (not just the domestic sector) and the scope for average costs to fall as networks grow, which may require investigation of more extensive heat networks than have been achieved in the UK. It would be a mistake to conclude from the marginal economics of the UK's fragmented patchwork of district heating schemes that the technology cannot offer a good price to consumers, if more comprehensive city-wide schemes would be able to support lower prices.

[1] Required under the EU Energy Efficiency Directive

2 Responses to questions

2.1 Transparency

2.1.1 Are consumers given sufficient information on heat networks before their decision to buy or rent a property that has a heat network?

When engaging with domestic consumers it would help the CMA's investigation to probe what consumers wish to compare when considering purchasing or renting property. Consumers *may* consider cost per kWh or standing charges to be important sites of comparison, but this may also be because these are the most readily available metrics on bills. The cost of keeping a home warm is another framing, as is the (often controversial) avoided cost of purchasing and maintaining a gas boiler.

Care should be taken in how costs are compared. One major actor in the UK district heating market has in the past advertised low energy bills for new-build homes connected to district heating by comparison of estimated annual bills with the costs of using gas to achieve an equivalent indoor climate regime but in an older property. The lower energy efficiency of the comparator means the district heating supply can have a relatively high cost per kWh, but this *prima facie* seems like an unfair comparison as the new building has to comply with tighter building control regulations. Consideration should be given to comparisons for heating properties built under the same building control regime. However, this is complicated to the extent that lower fabric standards can meet building standards requirements if heat supply is decarbonised.

2.1.2 To what extent are consumers able to assess and act upon information regarding heat networks prior to purchasing a property?

The CMA should take care in its expectations about what assessments consumers should be able to make about energy bills before purchasing a property. Household behaviour varies considerably, meaning that modelled energy consumption tends to account for only 40% of variation in energy demand (Palmer and Cooper, 2013). This makes it very difficult to give consumers adequate information on which to predict energy bills prior to purchasing a property (or switching to district heating without moving home, Webb et al., 2016). Consumers could be given estimates of the cost of a 'standard' consumption pattern, but this would be problematic for high and low energy users. Information about standing charges and unit rates are difficult to interpret as households need to estimate how their use of the property (e.g. temperatures and occupancy patterns) translate into energy demand. This task is beyond the reasonable capacities of even the most informed consumers. (Note predicted energy demand cannot be read off the household's consumption at a previous property as the thermal characteristics of the two homes are likely to be different and households may adopt different practices in different homes.)

2.1.3 To what extent is information on the costs of heat networks made clear to customers in bills?

The UK BEIS Heat Networks Consumer Survey 2017 compared heat network (HN) and non-heat network consumers, and found relatively poor transparency about costs for HN customers. HN consumers were less likely than non-heat network consumers to receive a bill, account summary or statement (HN: 62%, non-HN: 81%). HN consumers' bills, summaries and statements also tended to include less information. For example, they were around half as likely to be informed about amount of heating used (kWhs) (HN: 30%, non-HN: 61%); unit price (HN: 28%, non-HN: 57%); or standing charges (HN: 26%, non-HN: 47%).

A fifth of HN consumers (20%) said the billing information was 'too little'. This was moderately higher than among non-heat network consumers (14%). HN consumers on HNs not yet registered with the Heat Trust, and consumers without a meter, tended to be the least happy about the level of billing information received.

2.1.4 Do you have views on our proposed approach to data collection and analysis?

See general comments above.

2.1.5 Do you think that the potential remedies we are considering are appropriate? What are the potential benefits / risks in implementing such remedies and how should they be designed to maximise benefits? Are there other remedies that we should be considering?

Extending the regulation of metering and billing from electricity and gas to district heating would be a helpful step in regularising the latter. However, it may also be helpful to reconsider the information suppliers are required to include on bills to ensure consumers are aware of what they are paying for and why. Information on bills can be used to help households understand the relationship between their consumption and costs (and decide whether to do something about consumption levels, such as insulate their home), in which case it is equally helpful to consumers using different systems. Bill information can also be used to aid retail competition, but this is more straightforward when consumers are comparing tariffs for supply of the same commodity (e.g. gas) than when comparing gas with district heating supply. In addition to non-bill costs (such as boiler maintenance) different supply vectors have different carbon contents (and hence different implicit carbon subsidies). A progressive step towards transparency in heat decarbonisation and facilitating public debate on the fairness of the way decarbonisation costs are distributed would be to include estimated carbon emissions on energy bills. A further step would be to present emissions levels as a cost, using (for example) the government's non-traded carbon price values. In addition the Danish regulator requires online heat network cost comparison tables to be available, allowing heat network customers to compare their heat bill with others. This type of transparency is needed to improve best practice in the sector and encourages cost competition between networks.

2.2 Theme 2: Monopoly supply

2.2.1 Do heat networks exhibit natural monopoly characteristics (high fixed costs; economies of scale; barriers to further local entry to compete for existing customers)?

The 'natural monopoly' character of network infrastructure can be considered an opportunity or a threat, both of which in the past have been used to make a case for democratic oversight of energy networks (Hawkey et al., 2016). As a threat, the restricted scope for competition leaves consumers at risk of exploitation – this is the rationale for intervention the CMA has identified. As an opportunity, the economic characteristics that underpin the 'natural monopoly' characterisation means there is a case for government intervention to ensure the cost efficiency of a network is achieved, by coordinating lumpy investment with steady build-up of a user base. In relation to district heating, the opportunity-framing of district heating also relates to competition with other energy vectors. Two district heating networks running down a street is less efficient than a single network, but so too is a street along which half of buildings use district heating and half use gas. A German study (equivalent to the UK's "National Comprehensive Assessment…" referred to above) found the scope for district heating to be cost-competitive with gas quadrupled when modelled connection rates were doubled from 45% to 90% (Prognos AG et al., 2014), but such high connection rates require public planning and would be difficult to achieve on a voluntaristic competitive model.

Failure of UK public authorities to support the achievement of natural monopoly in the early twentieth century resulted in patchwork gas and electricity networks that were far less efficient than their European counterparts, and whose perceived dysfunction was part of the rationale for post war nationalisation (Arapostathis et al., 2013; Hawkey et al., 2016; Hughes, 1983). Scottish Government, in its proposals for Local Heat and Energy Efficiency Strategies and District Heating Zones (Scottish Government, 2017), is beginning to address these issues.

Given historical experience, the CMA should consider the *limits* to a competition- and market-based approach to district heating. This is not to claim that these concepts are not important, but that some forms of consumer detriment (and societal detriment) are better handled through other approaches, including public energy planning. This can support the necessary long term perspective on least cost solutions to mitigation of climate change, and HM Treasury (2015) Green Book Supplementary Guidance on valuing infrastructure investment, particularly in relation to creating and capturing the value of future options.

2.2.2 To what extent are consumers able to switch from their current heat network providers to alternative heat network operators or to alternative heat sources? What are the key factors (contractual and / or technological) impeding consumers from switching?

While the CMA may feel its remit requires it to promote switching as a remedy to consumer detriment, this approach would tend to work against securing the benefits (i.e. lower costs) of heat networks as natural monopolies.

We share the opinion that contractually forcing individual households to use (or at least pay for) district heating over long periods for the sake of the collective benefits (shared infrastructure and decarbonisation) is unlikely to be widely accepted in the UK. However, the question of technological impediment should be situated in consideration of the broader trajectory of heat decarbonisation. In particular, the absence of a gas network running in parallel with a district heating network in a high density area should not be interpreted as unfairly curtailing consumer freedoms as the use of natural gas for heating will have to decline over time.[2] Furthermore, the gas network is not accessible by every dwelling so is not a universal service. An alternative solution to cost competitiveness for heat network customers is to socialise the costs of the new infrastructure across the whole customer base for gas and heat in a unified heat regulatory model.

2.2.3 How do commercial and financial incentives at different levels in the value chain affect the decisions of builders, operators and residents?

The SoS identifies the split incentive problem, that developers required to install district heating to meet planning requirements are not incentivised to ensure whole-life costs for users are minimised. There is a clear case, then, for technical standards to be regulated, and for opportunities for efficiencies (through growth and interconnection of networks) to be supported by public authorities.

2.2.4 Do you have views on our proposed approach to data collection and analysis?

See general comments above.

[2] Natural gas may be replaced with hydrogen if carbon capture and storage technologies and infrastructures are developed, though this is not certain (Committee on Climate Change, 2016). However, hydrogen will be more costly than natural gas, meaning if there is a cost advantage in an area of natural gas over district heating this is likely only to be temporary, and better handled by socialising the costs of decarbonisation than by ensuring technological access to competing infrastructures.

2.2.5 Do you think that the potential remedies we are considering are appropriate? What are the potential benefits / risks in implementing such remedies and how should they be designed to maximise benefits? Are there other remedies that we should be considering?

If the investigation finds suppliers are using long term contracts with domestic users and/or large exit penalties, it would be appropriate to require amendments to these provisions (§69). It is important to the stability of heat network economic models (and ultimately consumer prices) that their customers continue to use them for long periods and in concentrated geographical areas, but this should be achieved by means other than contractual lock-in for domestic customers.

The distinction between a natural monopoly and 'potentially competitive segments of heat networks' should be handled with care (e.g. §77), and the model of unbundling in gas and electricity markets should not be assumed applicable to district heating. The UK model of unbundling features retailers who purchase energy on wholesale markets and compete with each other to supply consumers, with equal access to distribution infrastructure owned by regulated companies. In our international research we have not found this form of unbundling applied to district heating in any country. There are a number of factors that may explain this observation:

- Fixed infrastructure costs for district heating represent a larger share of total costs than gas and electricity networks. This restricts the scope for competition between suppliers using the same network to exert downward pressure on total costs.
- Competition increases the risk that heat generation assets (and infrastructure connecting them to distribution networks) become stranded. For energy systems with large, liquid wholesale markets, the social cost of associated write-downs may be outweighed by economic efficiency gains. But for district heating schemes with few heat generators the consequence of this increase in risk (which would lead to demand for higher returns pushing prices up) is likely to be more significant. Where we have observed competition among heat generators (under a single-buyer model) is in Copenhagen where a large heat network and multiple heat sources means the efficiency gain of price-controlled heat dispatch is considered to outweigh the costs of excess capacity and generators' volume risk premiums.
- The local scale of district heating schemes (and limited number of distinct heat sources) also limits the potential for suppliers to meaningfully broker distinct arrangements with heat generators, so scope for retail differentiation is low.
- Many district heating schemes rely heavily on revenues from electricity generation (this is particularly true in the UK where gas CHP is common). To the extent these cross-subsidise the costs of infrastructure an unbundled model would not be viable.

The SoS suggests collective switching may be appropriate where individual switching is not viable (§71). To the extent that collective switching preserves the level of heat demand across a heat network (and hence its financial viability), this may actually be preferable (both for individuals and realisation of collective objectives) to emphasising individual switching. Area-based concession models, such as exist in Norway or are being developed in Scotland, could be a route for achieving this. In effect, rather than regarding district heating networks as commercial assets, a concession model can be used to frame them as public utilities which some entity (either public or private) has the right to construct and operate over a given period according to particular requirements (which may include economic and environmental criteria). Collective switching would then be achieved at the end of the concession period or in the event that the delivery entity forfeits its rights (e.g. by failing to fulfil the concession requirements). An additional variant of collective switching is the introduction of a regulatory requirement for a supplier of last resort, should an operator fail to meet specified service and customer protection standards.

Area-based concessions, competitively tendered and time limited would also be a means of creating competition *for* the market (§70), without necessarily separating network construction from operation. There are many examples where aspects of design and build have been tendered by public authorities independently of arrangements for heat network operation (which may be held in-house). One perceived advantage of integrating operation with design/build in a contract is the alignment of incentives, mitigating issues discussed in the SoS (§§66-67).

2.3 Theme 3: Outcomes

2.3.1 Are heat network prices reasonable, and is quality of service and reliability adequate, when compared with alternative heat sources and/or operating costs?

As noted above, the reasonableness of low carbon heat prices should be thought of in terms of the costs of decarbonising heat as well as the cost effectiveness with which a particular solution (in this case district heating) has been implemented. Concentrating the costs of decarbonisation among early users of low carbon heat would seem unfair to those users but this wouldn't indicate these costs (which instead could be socialised) are illegitimate.

2.3.2 Do you have views on our proposed approach to data collection and analysis?

See general comment above.

2.3.3 Do you think that the potential remedies to control outcomes directly are appropriate? What are the potential benefits / risks in implementing such remedies and how should they be designed to maximise benefits? Are there other remedies that we should be considering?

The SoS (§75) suggests district heating prices could be regulated by reference to cost, previous prices or benchmark prices. It is unclear what is meant by 'previous prices', but economic regulation of district heating should consider both cost and benchmarks.

- Cost: in our international research, district heating users complain about heat prices a common concern is that they are being exploited by a district heating company making excessive returns. Typically these returns are not transparent. In the Netherlands regulation of district heating was initially driven by such concerns, but subsequent investigation of district heating businesses found the returns being extracted were actually quite low. To maintain confidence that district heating supply is fair, it is important that users or their representatives have access to financial data that allows assessment of the balance between costs and profits. This would require standardised methods for heat network business accounting (as have been built into Dutch district heating regulation). This can be thought of by analogy with the regulation of gas and electricity distribution network operators, though, as noted above (2.2.5), the unbundled model for gas and electricity is unlikely to be applicable to district heating, particularly during its establishment and growth.
- Benchmarks: in the UK it is common to compare district heating supply with a benchmark counterfactual, typically gas. In the absence of a carbon tax this comparison undermines the policy objective of heat decarbonisation. Nonetheless, benchmarking low carbon heat supply against alternatives could be an important means of ensuring the costs of heat decarbonisation are fairly distributed, though to achieve this would imply socialisation of heat decarbonisation costs across all heat consumers (principally via gas bills).

3 References

Advani, A., Bassi, S., Bowen, A., Fankhauser, S., Johnson, P., Leicester, A., Stoye, G., 2013. Energy use policies and carbon pricing in the UK (No. IFS Report R84). Institute for Fiscal Studies.

Arapostathis, S., Carlsson-Hyslop, A., Pearson, P.J.G., Thornton, J., Gradillas, M., Laczay, S., Wallis, S., 2013. Governing transitions: Cases and insights from two periods in the history of the UK gas industry. Energy Policy 52, 25–44. https://doi.org/10.1016/j.enpol.2012.08.016

Committee on Climate Change, 2016. Next Steps for UK Heat Policy.

Energy Research Partnership, 2017. The transition to low-carbon heat.

Frerk, M., MacLean, K., 2017. Heat decarbonisation: potential impacts on social equity and fuel poverty. National Energy Action.

Hawkey, D., Webb, J., Lovell, H., McCrone, D., Tingey, M., Winskel, M., 2016. Sustainable urban energy policy: heat and the city. Routledge, Abingdon, Oxon ; New York, NY.

Helm, D., 2017. Cost of energy review.

HM Treasury, 2015. Valuing infrastructure spend: supplementary guidance to the Green Book.

Hughes, T.P., 1983. Networks of power: Electrification in Western society 1880–1930. Johns Hopkins University Press, Baltimore.

King, M., Shaw, R., 2010. Community energy: planning, development and delivery. Combined Heat and Power Association (CHPA).

MacLean, K., Sansom, R., Watson, T., Gross, R., 2016. Managing Heat System Decarbonisation: Comparing the impacts and costs of transitions in heat infrastructure. Imperial College Centre for Energy Policy and Technology.

Northern Gas Networks, Wales and West Utilities, Kiwa, Amec Foster Wheeler, 2016. Leeds City Gate H21.

Palmer, J., Cooper, I., 2013. United Kingdom housing energy fact file 2013. Department of Energy and Climate Change.

Prognos AG, Fraunhofer IFAM, IREES, BHKW-Consult, 2014. Potenzial- und Kosten-Nutzen-Analyse zu den Einsatzmöglichkeiten von Kraft-Wärme-Kopplung (Umsetzung der EU-Energieeffizienzrichtlinie) sowie Evaluierung des KWKG im Jahr 2014.

Ricardo Energy and Environment, 2015. The national comprehensive assessment of the potential for combined heat and power and district heating and cooling in the UK: Report for DECC.

Scottish Government, 2017. Second consultation on local heat and energy efficiency strategies, and regulation of district and communal heating.

Webb, J., Hawkey, D., Mccrone, D., Tingey, M., 2016. House, home and transforming energy in a cold climate. Families, Relationships and Societies 5, 411–429. https://doi.org/10.1332/204674316X14758447787663