

Item No. 6	Classification: Open	Date: 18 September 2024	Meeting name: Housing, Community Safety and Community Engagement Scrutiny Commission
Report title:		Gas consumption in district heating networks	
Ward(s) or groups affected:		All wards	
From:		Director of Asset Management	

RECOMMENDATIONS

1. The Housing, Community Safety and Community Engagement Scrutiny Commission is asked to note the contents of this report.

BACKGROUND INFORMATION

2. Leaseholders from the North Peckham and Gloucester Grove estates brought a deputation to Council Assembly on 17 July 2024 where they explained the findings of a resident-led investigation into the levels of gas consumption within the district heating system on those estates and the associated high service-charge costs.
3. The Cabinet Member for Council Homes committed to looking into the issues raised and has been working with officers to ensure this is done. The North Peckham investigation is ongoing, and officers and the cabinet member have already met with residents from North Peckham to update them directly.
4. The Housing, Community Safety and Community Engagement Scrutiny Commission have requested a report investigating the gas consumption in the council's district heating networks.

KEY ISSUES FOR CONSIDERATION

Gas consumption with council heat networks

5. The council's heat networks use around 19,000 kWh of gas per property on average. This is more than an average property with an individual gas boiler (approximately 11,500 kWh for a 2-3 bedroom property according to Ofgem). There are several reasons for this higher consumption.
6. Firstly, network losses. Heat networks use a series of insulated pipes to convey hot water from a boiler house or energy centre to the properties. It is impossible to delivery 100% of the heat generated as all hot surfaces

lose thermal energy via conduction, convection and radiation. The pipe insulation seeks to minimize the losses but cannot eliminate it.

7. Heat networks are generally split into four key components:
 - Energy centre (or boiler house)
 - Primary network – the buried or inter-building pipes
 - Secondary network – the pipes within buildings before they reach the dwellings
 - Tertiary network – the elements within the dwellings (pipes and radiators, hot water cylinders etc.)

8. Best practice for newly designed and built heat networks can be taken as not losing more than 10% of heat within the primary network, and 10% within the secondary network. Even if running a 90% efficient gas boiler, the overall efficiency at best practice level would be $0.9 \times 0.9 \times 0.9 = 73\%$. 'Minimum standard' for new networks would be more like 15% loss in each stage, resulting in $0.85 \times 0.85 \times 0.85 = 61\%$

9. If the 11,500 kWh gas from the Ofgem figure were used in a 90% efficient boiler, it would deliver 10,350 kWh of useful heat into the property.
 - A 'best practice' modern heat network supplying 10,350 kWh useful heat would use in the region of $10,350 \div 73\% = 14,178$ kWh gas
 - A 'minimum standard' modern heat network supplying 10,350 kWh useful heat would use in the region of $10,350 \div 61\% = 16,967$ kWh gas

10. In addition to this, the underlying useful heat-delivered figure may be higher than 10,350 kWh. The Ofgem figure of 11,500 kWh applies where gas is measured and billed to each individual, providing an economic incentive for efficient behaviour. Heat networks without heat meters do not provide the same granularity of financial incentive. The installation of heat meters is generally found to reduce gas consumption within a heat network by 20%.

11. If the assumed 10,350 kWh heat is divided by 80% (based on a 20% saving) before dividing by the 73% and 61% network efficiencies, the resultant gas use might be in the region of 17,723 to 21,209 kWh per property.

12. In this context, the council's average of 19,000 kWh of gas per dwelling is not as exceptional as it may seem at first. Having said this, targeting lower gas consumption should be a priority to achieve cost and carbon savings. This could be through installing heat meters, better controls, improving pipe insulation or simply targeted energy management.

13. It is also the case, that while most sites use less than or only slightly higher than the average, around ten sites have significantly higher gas use. We will come back to this later in the report.

Are heat networks efficient?

14. It is often claimed that heat networks or district heating systems are more efficient than individual heating. From a pure energy efficiency perspective, that is definitely not the case. Individual heating systems which generate heat within the home, do not have any distribution losses at all (or at least any losses that do occur, such as from a hot water cylinder, are often useful in providing drying or background heating).
15. District heating systems do have benefits, however, such as:
 - Usually lower energy prices available through bulk purchase
 - Shared maintenance costs
 - Easier access to heating equipment for repair or maintenance
 - Better local air quality (fewer taller flues, rather than many low level flues from individual boilers)
 - Easier to decarbonise (from the ability to plug in alternative heat sources such as waste heat or ground source heat pumps)
16. With better energy prices and shared maintenance, it is perfectly possible, though not inevitable, that district heating systems will offer better value for money, or cost efficiency, despite losing some heat in the networks. It is important, therefore, that the council chooses its words carefully when explaining the benefits of district heating.

Understanding gas consumption levels at North Peckham

17. Having explored gas use within the council's heat networks at large, and sought to understand those numbers, we will now turn our attention to the North Peckham network.
18. The council has checked consumption through the gas meter in great detail to rule out any errors. North Peckham has a large gas meter operating under the medium pressure regime. As well as the main volume meter, there are also temperature and pressure sensors monitoring the gas supply and a 'volume corrector' which calculates a Correction Factor to apply to the volume measured by the main meter.
19. North Peckham is the council's only medium pressure gas supply and the value of the Correction Factor makes a significant difference to the bills. The accuracy of the temperature and pressure sensors has been checked by the Meter Asset Manager and verified with calibrated equipment. These maintenance and calibration visits are carried out periodically.
20. These consumption checks have confirmed the consumption at North Peckham to be around 20.6 GWh of gas annually. This is an average from the last five financial years. With 734 connected dwellings, that works out as 28,100 kWh of gas per property.
21. In addition to the homes connected on the North Peckham and Gloucester Grove estates, a portion of the Tuke School is also heated by

the district heat network and this is allocated a gas cost on the basis of being equivalent to a 33 bedroom property (37 “room units” equivalent to just over six 2-bedroom homes). However, the Tuke School also has a hydrotherapy pool and it is possible that this allocation is not sufficient to cover the actual heat used.

22. The council is currently preparing to install a heat meter at the school to see if the gas allocation is correct or not.
23. Regardless of whether Tuke School uses more than its allocation or not, it seems likely that the system overall uses more than the average 19,000 kWh of gas per dwelling.
24. There are several reasons why this could be. The following paragraphs explore these reasons using the categories of losses presented above in paragraph 7.
25. **Energy centre / boiler house** – the main gas boilers within the North Peckham boiler house were quite old until recently, with ages ranging up to 40 years (they are currently being replaced with new ones as part of an overall boiler house refurbishment).
26. **Primary network** – the primary network at North Peckham is a Medium Temperature Hot Water (MTHW) system with water supplied at up to 110°C to the plant rooms. These higher temperatures (most of the council’s systems run at around 80°C) are necessary due to the size of the network and the types of heat exchangers in the plant room, but higher temperatures will lead to higher losses. The other factor which will increase losses compared to other systems is the length of primary pipe – for historical reasons the boiler house is not actually located on the estate, thus the primary network needs to travel around 200 metres before it reaches the estate.
27. **Secondary networks** – the secondary network at North Peckham and Gloucester Grove is a 4-pipe system. The council has a mix of 2-pipe, 3-pipe and 4-pipe systems. All modern systems are 2-pipe as this minimises losses. 3-pipe and 4-pipe systems were commonly designed before the advent of variable speed pumping. In these systems, separate pumps serve the space heating and hot water circuits. In the summer, the space heating circuits are turned off and isolated. Unfortunately, 4-pipe systems suffer from higher heat losses than 2-pipe and 3-pipe systems.
28. **Tertiary networks (dwellings)** – As already noted in paragraph 10, the absence of dwelling heat meters means that residents do not currently have a financial incentive to turn off heating when it is not needed. Residents have also reported recently that some properties on the estate are not able to properly turn off their heating, or even that heating is on in the summer when it should have been turned off and isolated. If this is the case, that would also lead to additional gas wastage.

Next steps for North Peckham

29. The following next steps are planned for the North Peckham heat network:
- Install heat meter at Tuke School
 - Complete refurbishment of boiler house
 - Carry out heat network optimisation study
 - Potential for works to secondary network (possibility of Heat Network Efficiency Scheme HNES grant funding)
 - Likely dwelling heat meter installations (awaiting details of Heat Network Market Regulation, see below from paragraph 40)
 - Potential SELCHP heat network connection

Other heat networks

30. As already noted in paragraph 13, some of the council's heat networks use more than the average and more than the expected range of consumption. The gas use per dwelling for each estate is provided in Appendix 1.
31. As seen in the example of North Peckham, there may be detailed technical reasons for this, such as higher temperatures or older network architecture.
32. Beyond North Peckham, a few other specific estates have raised the question of whether their gas use is higher than it should be. These are Canada Water, Consort, Setchell and Sydenham Hill. The gas use figures for these estates are Canada Water - 15,025 ; Consort – 24,461 ; Setchell – 19,088 and Sydenham Hill – 21,084. All figures are average kWh of gas consumed per property in the last two financial years.
33. The only one of these which is above the expected range laid out in paragraph 11 is the Consort estate. Here the boilers are very old (early 1980s) and coming up for replacement. There may also be a need to improve insulation of some block pipework, and potentially improve controls at the time of adding heat meters (subject still to upcoming regulation changes, see from paragraph 40).

Does the council have a plan?

34. In developing the Heat Networks Strategy, approved by cabinet in September 2021, the council analysed a range of data in order to prioritise investment. The main data points assessed were system condition, gas consumption, availability and customer satisfaction. Based on this analysis, certain sites were prioritised for different actions – some for replacement pipework, some for feasibility studies and some for boiler renewal.
35. In the last few years the following works have been completed:
- Albert Barnes boiler house, risers, dwelling internals, heat meters

- Aylesbury estate boiler house and plant rooms
 - Brimington and Pomeroy underground mains
 - Consort, Newington, Wyndham water source heat pumps
 - Cossall estate boiler house
 - Fielding Street boiler house
 - Harfield Gardnes boiler house
 - Masterman House boilers, risers, dwelling internals, heat meters
 - Perronet House boiler and flue work
 - Primrose House boiler house
 - Rouel Road and Four Squares plant rooms
 - Salisbury underground mains
 - Sydenham Hill replacement boilers
 - Wyndham estate underground mains (phase 1)
 - North Peckham boiler house (in progress)
 - Newington underground mains (in progress)
 - Dighton Court boiler house (in progress)
 - Sceaux Gardens replacement boilers (in progress)
 - Silverlock estate hot water system
36. In addition to the above, statutory cost-effectiveness tests, required by the Heat Networks (Metering and Billing) Regulations were also carried out in 2021 which defined a list of estates where dwelling heat meters were required. The council has now installed nearly 1,000 heat meters in existing properties across Cossall estate, Crane House, Osprey estate, Sceaux Gardens and Surrey Docks (Downtown North & South Estates). We also have around 900 heat meters in new homes where they are required from the time of construction.
37. In January 2024, after resident consultation, the council adopted a Heat Metering Policy which outlines how we aim to deliver heat metering in the borough to balance different policy objectives such as energy efficiency and preventing fuel poverty.
38. As part of the Heat Network Strategy, it was recognised that some investments that the council may wish to make in its heat networks would be expensive, and that external grant funding could play an important role. In the last three years, the Council has secured significant external funding:
- Water Source Heat Pumps (at Consort, Newington and Wyndham) – Mayor’s Energy Efficiency Fund (MEEF) low interest loan + Renewable Heat Incentive (RHI) revenue grant
 - SELCHP project – government Heat Network Investment Project (HNIP) grant and loans
 - Dighton Court, Sceaux Gardens, Arica House, Osprey Estate – Heat Network Efficiency Scheme (HNES) capital grants
 - Sydenham Hill – HNES revenue grant for a feasibility study
 - Brandon Estate – GLA Local Energy Accelerator feasibility funding
39. The council is not blind to some of the challenges of operating older heat

networks and does have a plan for improving things. This does not mean that the plan is perfect or that the challenges will be easy to resolve. Indeed there are some particular areas of challenge that we are aware of, including the following:

- Recruitment – we need a larger team working on resolving some of the problems. Several rounds of recruitment have been run without being able to fill key posts. This could be due to general skills shortages in the sector or other factors.
- Energy management – a recent internal service review identified that central energy procurement and management may not be the most suitable model. While central energy procurement makes sense, having specific staff resource distributed within the departments and service areas that actually use the energy could be more fruitful.
- In particular, the gas benchmarking completed for the Heat Networks Strategy and presented in Appendix 1, could be undertaken more regularly alongside the billing checks completed by procurement colleagues.
- Upcoming regulation – we know that installing more heat meters will help to improve the energy efficiency, cost efficiency and controllability of many networks. However, we also know that upcoming heat network regulation (see below from paragraph 40 is almost certain to change the legal requirements around heat metering). It is therefore difficult at the present time to press ahead with more metering, until we have certainty of the requirements.

Upcoming market regulation

40. As well as internally-driven improvements, the Energy Act 2023 paved the way for statutory regulation of heat networks. Regulations will be implemented through secondary legislation. There are three main parts to the planned regulations:
 - Authorisation and consumer protection – heat network operators (such as the council) will need to be authorised by Ofgem and adhere to certain consumer protection rules (still being defined)
 - Heat network zoning – central and local government will work together to define zones where heat networks are the most cost-effective route of decarbonising an area. Zones will be refined and declared, and procurement exercises run to appoint the development and delivery of new heat networks
 - Technical standards – heat network operators will have to ensure their networks comply with minimum technical standards relating to performance and efficiency. Each network will have to be certified against the standards.
41. One of the authorisation or technical standards that is likely to be introduced is the requirement for heat metering in more (or possibly all) dwellings, or at least those where it is technically possible to meter. We don't yet know, however, the specifics of such changes.
42. Although the final details are not yet known, it is clear that the council, and

indeed all heat network operators, will be required to improve the performance of its heat networks.

CONCLUSION

43. Although the council's heat networks use significantly more gas on average than Ofgem's estimate of normal use within individual systems, there are some reasons for this – the nature of heat distribution (where some losses are unavoidable), the absence of heat meters in most networks, and the age of many of the systems.
44. Some systems, like North Peckham, use more than the council average and this is due to specific technical factors such as higher temperature networks, longer networks and different network architecture (4-pipe systems).
45. Systems with the highest consumption have generally been prioritised for works to improve the efficiency, though other factors have also been used to prioritise works such as reliability. Many work streams are ongoing to improve the situation for estates generally. A specific set of actions has been identified for North Peckham.

BACKGROUND DOCUMENTS

Background Papers	Held At	Contact
Heat Networks Strategy Cabinet 14 September 2021	Southwark Council, 160 Tooley Street, London, SE1 2QH	Paula Thornton 020 7525 4395
Link: https://moderngov.southwark.gov.uk/documents/s101251/Report%20Heat%20networks%20strategy.pdf		

APPENDICES

No.	Title
Appendix 1	Gas use per dwelling
Appendix 2	N/A

AUDIT TRAIL

This section must be included in all reports.

Lead Officer	Stuart Davis, Managing Director Southwark Construction (and Interim Director of Asset Management)	
Report Author	Tom Vosper, Strategic Project Manager – Heat Networks	
Version	Final for Scrutiny Committee	
Dated	9 September 2024	
Key Decision?	No	
CONSULTATION WITH OTHER OFFICERS / DIRECTORATES / CABINET MEMBER		
Officer Title	Comments Sought	Comments Included
Director of Law and Governance	No	No
Strategic Director of Finance and Governance	No	No
List other officers here		
Cabinet Member	Yes	Yes
Date final report sent to Constitutional Team / Scrutiny Team	09/09/2024	

Note: Consultation with other officers

If you have not consulted, or sought comments from the director of law and governance or the strategic director of finance and governance, you must state this in the audit trail.