Techno-economic assessment of externally accessible HIUs on low temperature heat networks

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1.0 Introduction

Many UK heat networks currently experience a significant performance gap between design and operation. The most common and significant cause of this is poor HIU performance.

Gaining access to dwellings to rectify issues can be a difficult and costly process. It only requires a small number of poorly performing HIUs to have a significant impact on network performance. Therefore, readily available access to 100% of the HIUs is essential to sustain good network performance. External HIUs enable full access for maintenance and servicing at any time, removing a key barrier and cost to ensuring good network performance.

Another factor in network performance is the volume of Low Temperature Heat Network (LTHN) pipework, which impacts heat losses. Dwelling LTHN (terminal run) pipework is typically 4-7 m long, which makes up a significant portion of total pipework when added up across all dwellings in a development. External HIUs reduce this terminal run length to nearer 1 m/dwelling and so significantly reduce the total LTHN pipework volume.

External HIUs also enable the use of multiple risers, enabling a further reduction in network length. This strategy enables most of the lateral (corridor) pipework to be removed from the network. In addition to the reduction in heat losses this offers, decreasing the total length of the heat network also greatly reduces the system CAPEX.

However, external HIUs cannot be counted as part of the development Net Internal Area (NIA), as they would not be accessible (from dwellings or corridors) for use as storage space. Therefore, specification of external HIU cupboards decreases the total dwelling area (seen in Figure 1), causing a reduction in revenue from sales.

The aim of this techno-economic assessment is to determine the magnitude of the CAPEX and OPEX savings compared to the financial impact of reducing the NIA to determine under what conditions external HIUs are a financially viable option.

2.0 Inputs and considerations

The two network configurations to compare in the model are:

- Internal HIUs, with 1 riser per block and lateral pipework on each floor
- External HIUs served by multiple risers

Indicative layout drawings of the options are shown in Figure 1.

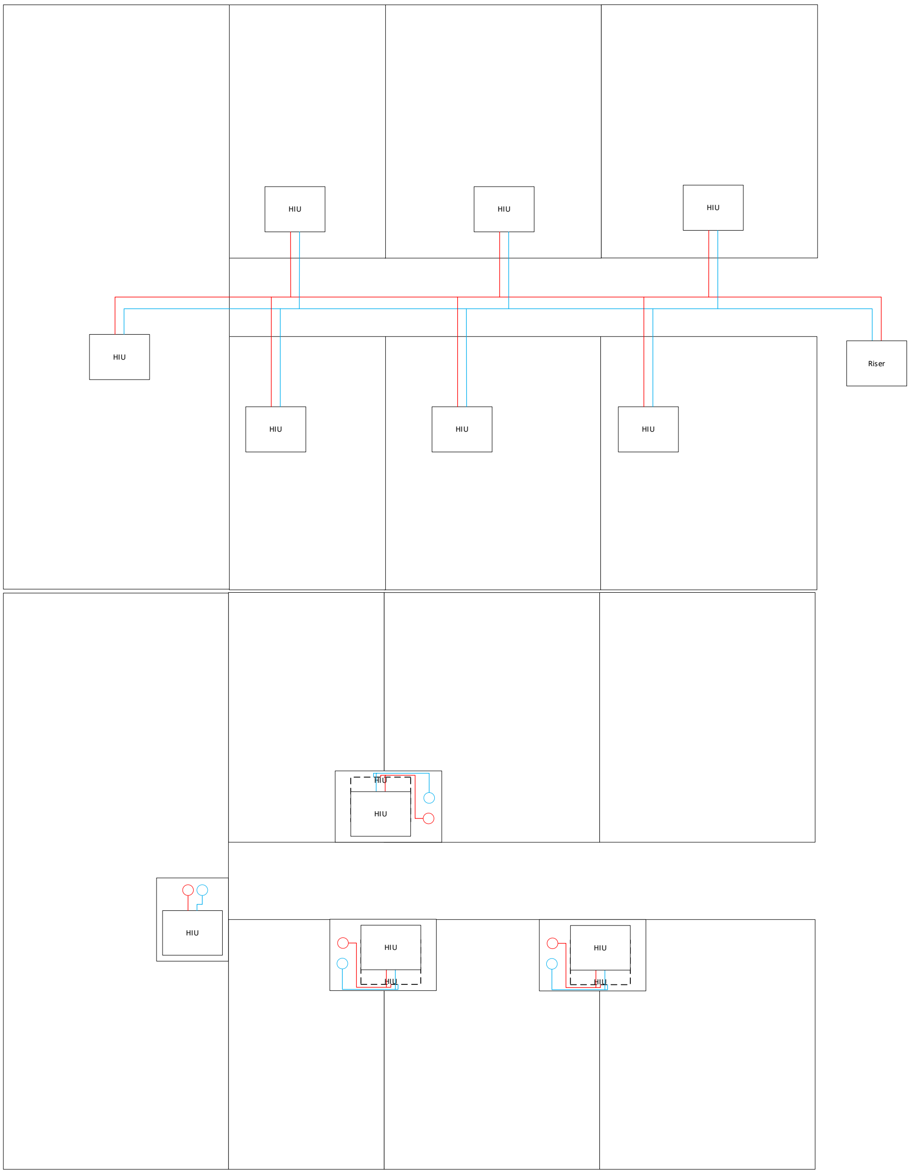


Figure 1: Indicative layout drawings of internal HIUs with 1 riser (above) and of external HIUs and multiple risers (below)

The details of the key financial, CAPEX and OPEX considerations in this analysis are presented in Sections 2.1 – 2.3.

This analysis has been performed over a 30-year period at a discount rate of 3.5 %. This timeframe is the estimated lifespan of all original network and dwelling equipment before replacement of components requires consideration. The discount rate has been set in line with *'The Green Book - Central Government Guidance on Appraisal And Evaluation'*.

The optimal HIU cupboard design involves 2 HIUs, aligned one above the other, to minimise the footprint required. However, if the development layout contains an odd number of dwellings per floor, it is not possible for all cupboards to contain 2 HIU and some single HIU cupboards will be required.

2.1 Revenue Impact

The key variables that affect the revenue impact of external HIUs are:

- Revenue from dwelling sales (£/m^2) for a build to sell development
- Revenue from rent (£/m^2/yr) for a build to rent development
- Total HIU cupboard footprint

2.2 CAPEX

The impact of external HIUs on capital costs during construction can be split into network and dwelling costs.

2.2.1 Network costs

The key variables that affect the network costs of external HIUs are:

- Pipework length
- Pipework and insulation coordination
- Riser ancillary equipment
- Terminal run ancillary equipment

External HIUs will likely enable further minor construction and commissioning benefits than those detailed above (e.g., reduced waste on site), but these have not been included in the model as they are difficult to quantify.

2.2.2 Dwelling costs

The installation of external HIU cupboards would involve additional costs, which are:

- Extra door and lock (per cupboard)
- Extra walls and thermal lining (per cupboard)
- Additional tertiary pipework to route dwelling services from HIU to dwelling (per dwelling)
- Cold water
- Domestic hot water
- Space heating
- Extra wiring from heat meter to smart meter (per dwelling)

It is likely that a bulk discount would be available on the materials required for the cupboards, or on the cupboards themselves if an offsite manufacturer is used. A 20 % cupboard bulk discount is typical in the industry when procuring capital equipment. As the cupboards are mostly made from raw and intermediate materials, this discount may be larger in practice.

2.3 OPEX

The main impacts to heat network operation costs are the energy, maintenance and servicing costs.

2.3.1 Energy costs

The key variables that impact energy costs are:

- Heat losses
- Length of heat network pipework
- Network operating conditions
- Insulation thickness and consistency
- HIU performance
- Cost of energy
- Carbon cost of energy

It should be noted that the reduction in carbon emissions could also be modelled to impact the development offset payments.

2.3.2 Maintenance

The only maintenance that enables a financial saving with external HIUs is the rectification of HIU faults that impact network performance but do not impact resident comfort (e.g., bypass through either PHE). Arranging access is typically easy if a serious fault were to occur (e.g., no hot water) and the difference is costs between internal and external HIUs would therefore be minimal.

The key variables that impact maintenance costs are:

- HIU fault rate
- Time & costs to arrange access
- Contractor costs

2.3.3 Servicing

The key variables that impact scheduled servicing costs are:

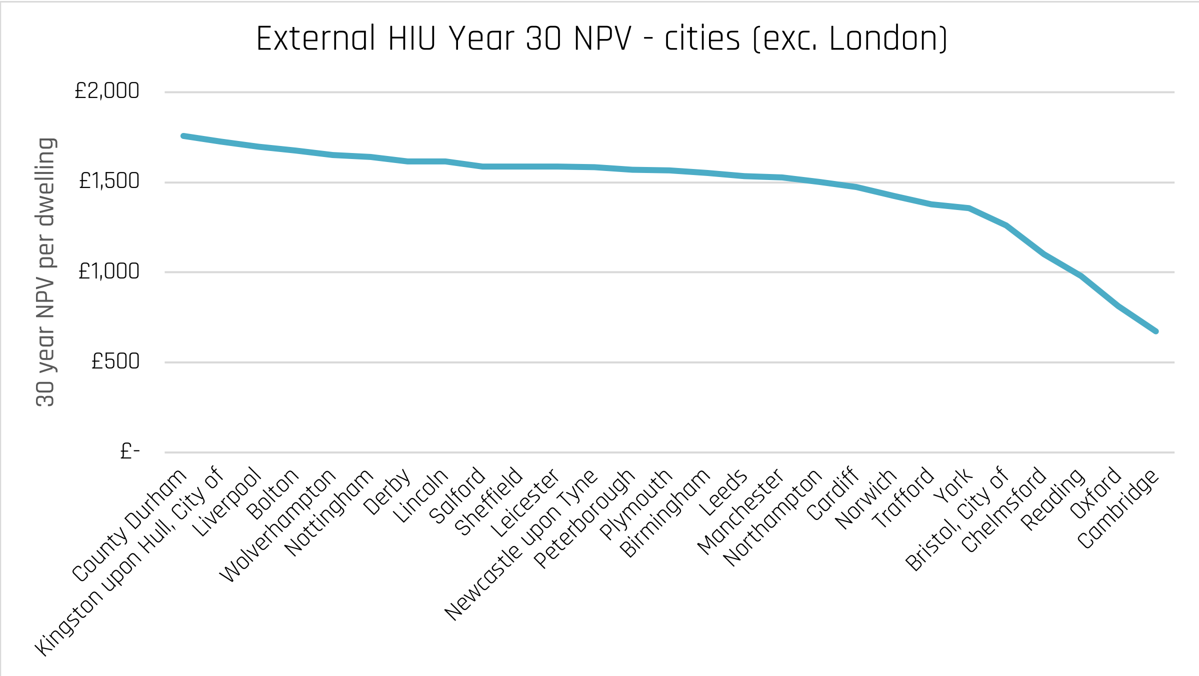
- Frequency of servicing
- Time & costs to arrange access
- Time & costs to arrange revisits (due to missed appointments or to replace a faulty component)

3.0 NPV Assessment

Figure 2 shows the impact of external HIUs compared to the counterfactual network configuration over 30 years at a 3.5% discount rate.

This analysis shows that over a 30-year operational period, external HIUs are beneficial in all regions of the country, with the exception of the most expensive parts of London.

The savings arise as this strategy enables pipework length to be reduced by c. 65 % compared to single riser, internal HIU networks and a significant reduction in maintenance project management costs. When combined with a top of riser keep warm strategy, this enables heat losses to be reduced by 60-70 %, to approximately 40 W/dwelling.



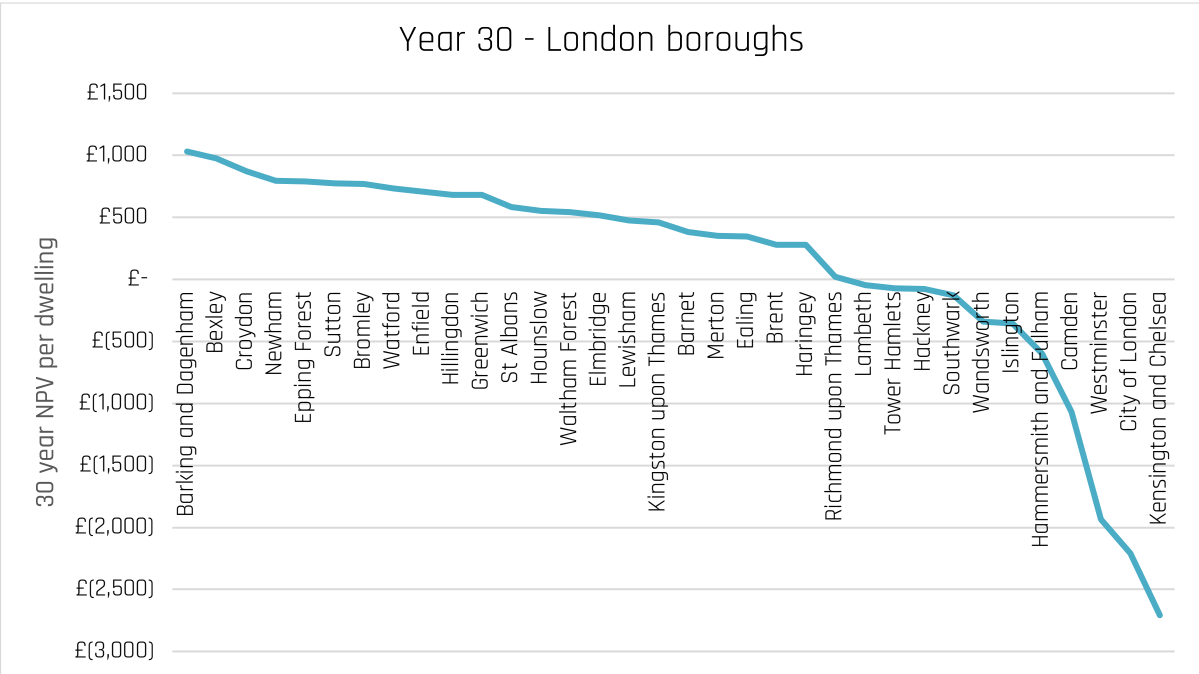


Figure 2: Regional variation in 30-year NPV with changing price of sellable area (£/m^2) at a 3.5% discount rate