THE FUTURE ROLE OF THE LONDON PLAN IN THE DELIVERY OF AREA-WIDE DISTRICT HEATING

BUROHAPPOLD ENGINEERING

Executive Summary – 29th June 2017

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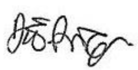
signature	
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THE FUTURE ROLE OF THE LONDON PLAN IN THE DELIVERY OF AREA-WIDE DISTRICT HEATING – EXECUTIVE SUMMARY

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INTRODUCTION

- The roll out of heat networks to connect sources of low cost, low carbon and renewable heat to consumers is a core part of London's approach to decarbonising its building stock. The existing London Plan promotes heat networks as a key mechanism for the decarbonisation of new developments and requires boroughs to play their part in heat network planning and development.

- The Greater London Authority's (GLA) London Plan energy hierarchy, outlined in Policy 5.2 Minimising carbon dioxide emissions, requires new building development to follow the energy hierarchy when proposing site energy strategies to achieve carbon reductions:
  1. Be lean: use less energy
  2. Be clean: supply energy efficiently
  3. Be green: use renewable energy

- The GLA London Plan policy 5.5, Decentralised energy networks, is in place to achieve the Mayoral targets for decentralised heating and cooling networks. For District Heat Networks (DHN) to be expanded, schemes ranging from single blocks to area-wide developments should be designed to directly connect or safeguarded to connect to such networks. DHNs are seen as a way to increase renewable and low carbon technologies to decarbonise heating and cooing demands.

Sources:
1. The London plan the spatial development strategy for London, Consolidated with alterations since 2011, Greater London Authority, March 2016
2. Powering Ahead: Delivering Low Carbon Energy for London, October 2009 https://www.london.gov.uk/sites/default/files/mayor-publications-2009-docs-powering-ahead141009.pdf

STUDY OBJECTIVES

- The GLA requested consultancy advice to undertake a review of the existing London Plan policy within the context of changing carbon factors being considered at a national level. The aim was to understand the impact of retaining the existing policies on the deployment of site-wide heat networks in new developments and the ability for those developments to meet the mayors' zero carbon ambitions and onsite CO_2 reduction targets.

- The objectives of the study are to:
  - understand the implications of the proposed changes to the Standard Assessment Procedure (SAP) from the 2016 consultation by BEIS;
  - how the changes would impact the current London Plan energy hierarchy and the resulting deployment of communal heating systems in line with it;
  - test the ability for new typical residentially-led applications to meet carbon reduction targets; and
  - consider the subsequent cost of heat to consumers for each option.

- The study aims were to includes a quantitative and qualitative assessment of the objectives, as well as consider lessons learnt from other relevant policy and best practice from the UK and around the world. This study is to provide an evidence base for changes to the London Plan currently being written by the GLA.

- Two development scenarios were chosen for assessment through this study. Marginal development types (a small single block and a medium sized mixed use scheme) were chosen whilst larger area-wide development was excluded. These are denoted as scenario 1 and scenario 2 respectively. Six heat supply/servicing options were chosen to analyse a wide spectrum of technologies that cut across the Lean, Clean, Green energy hierarchy. These are outlined in the following graphs and in more detail in the main report.

CARBON INTENSITY OF HEAT ANALYSIS

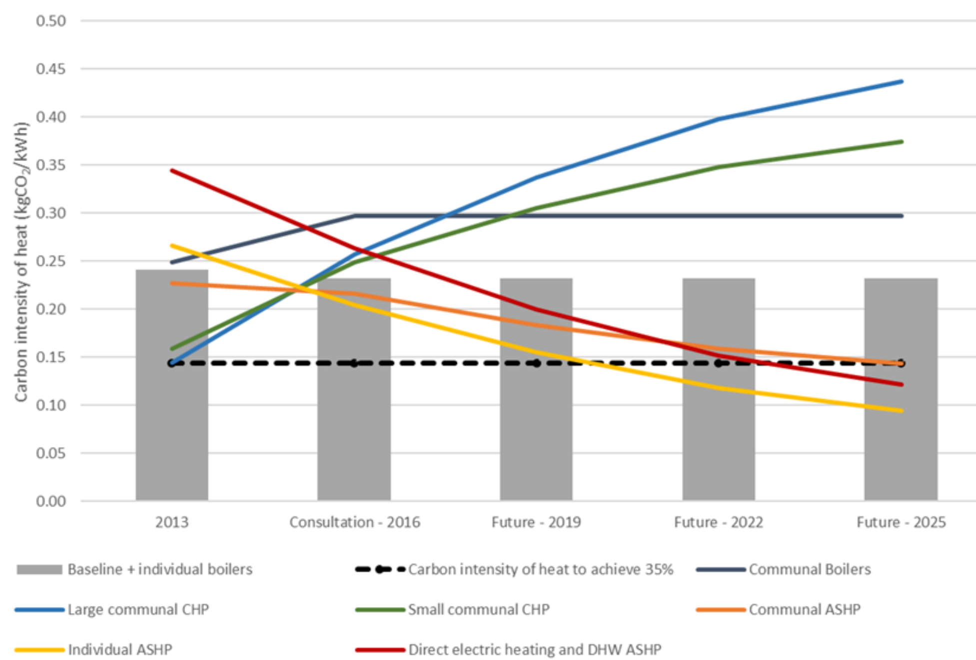
The carbon intensity of heat is the amount of Carbon Dioxide emitted in kilograms from producing a Kilowatt hour (kWh) of heat at point of use.

The graph shows the expected changes to the carbon intensity of heat by future set of BRE carbon factors by heat technology.

The analysis shows that from SAP 2019 onwards, gas engine CHP does not provide savings of delivered heat compared to communal boilers.

The carbon intensity of heat to achieve 35% has been assumed to be ~ 0.15kgCO_2/kWh. This is because this can be achieved by communal gas engine CHP engines in Part L 2013.

All electric options are expected to achieve this carbon intensity by 2025. Individual Air Source Heat Pumps (ASHPs) show the lowest carbon intensity due to no communal losses and can meet this carbon intensity by 2022.



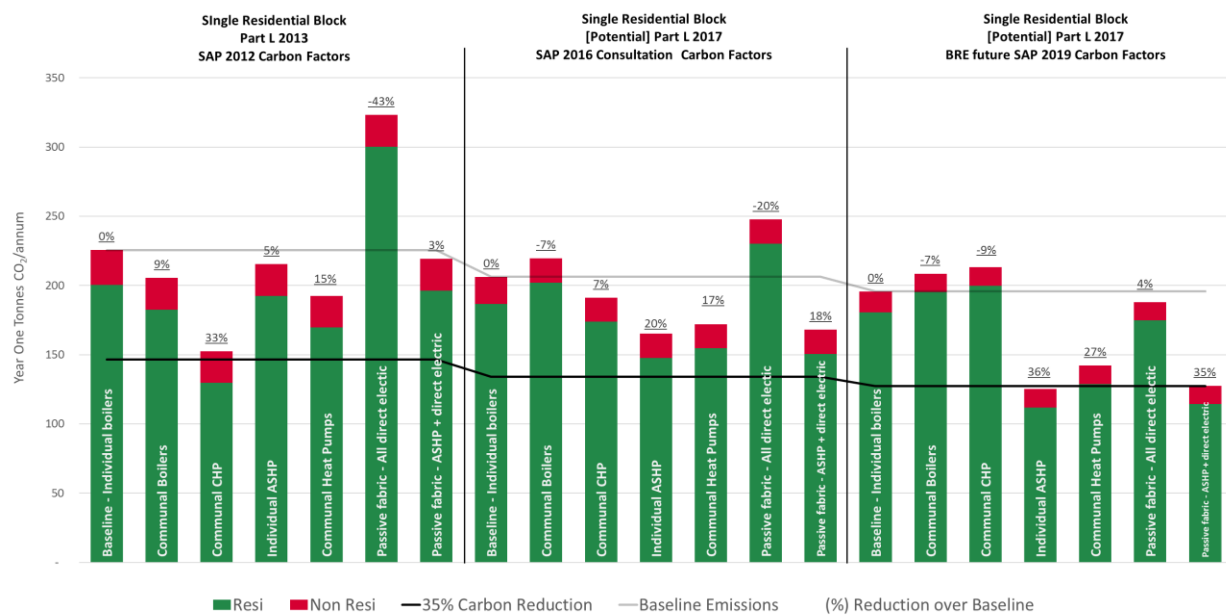
FUTURE CARBON REDUCTIONS:
SCENARIO 1 – SINGLE BLOCK

Analysis shows that gas engine CHP under current Building Regulations Part L 2013, is considered the heat supply technology that provides ~35% carbon reductions for single block and medium scale developments.

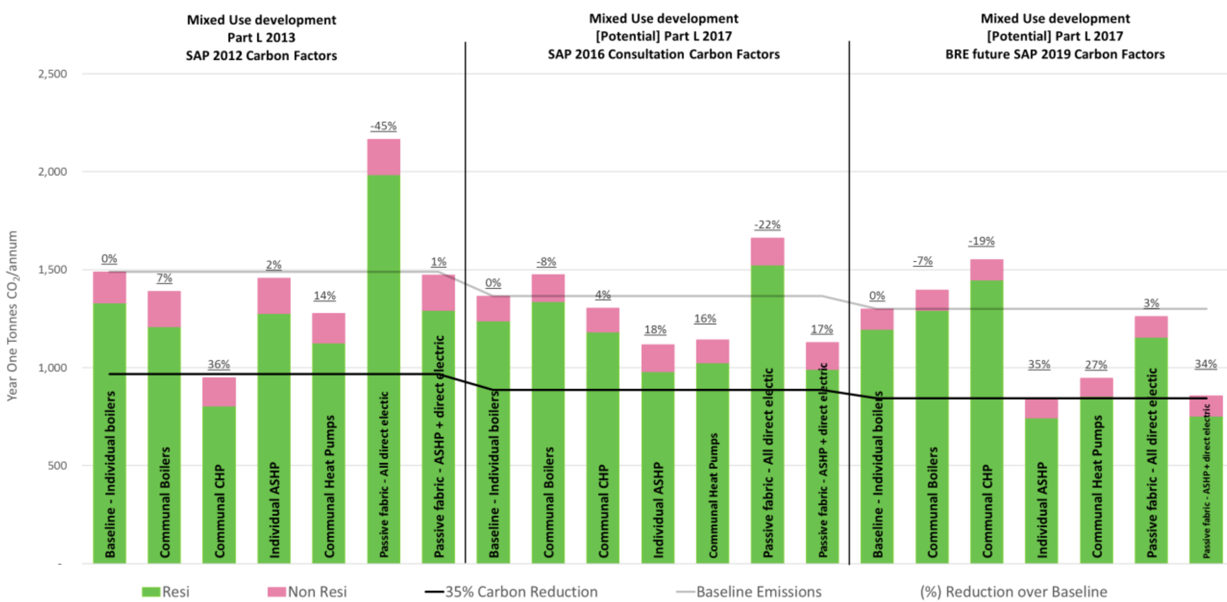
This study excluded large scale heat networks, which may also show the same results.

The analysis also shows that as SAP 2016 and beyond come into force there is likely to be a transition period in carbon reductions.

Using SAP 2016, no single option meets the 35% reduction target. Furthermore, gas engine CHP does not meet the baseline and does not provide carbon reductions at the time.



FUTURE CARBON REDUCTIONS:
SCENARIO 2 – MIXED USE



However, beyond 2019 electric heat technologies perform much better due to BRE projections of Grid decarbonisation.

Heat pumps utilised in individual dwellings or communal heating systems, show carbon savings in all years, over the baseline, increasing to between 27 – 36% using SAP 2019 carbon emission factors.

Systems that utilise passive building fabric will reduce heating demand and therefore provide carbon reductions. However heat pump technologies are required to provide significant carbon reduction beyond expected Building Regulations in force at the time.

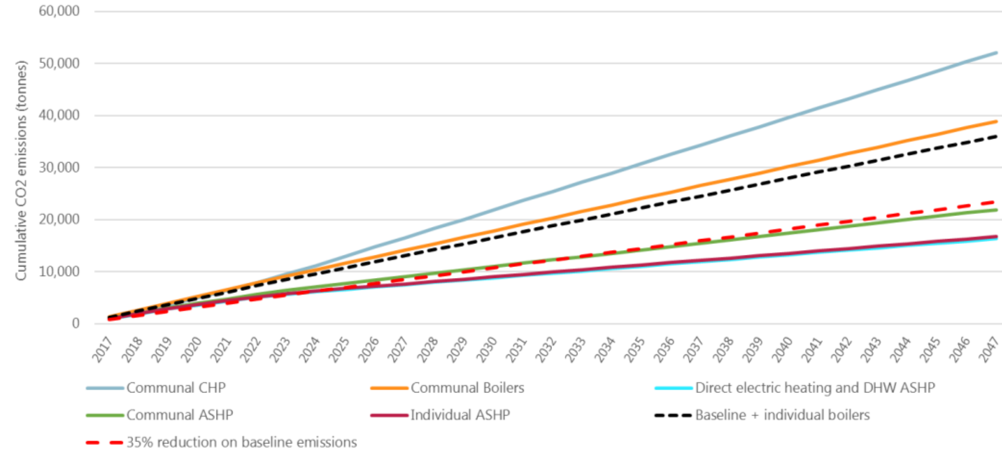
CUMULATIVE CARBON EMISSIONS

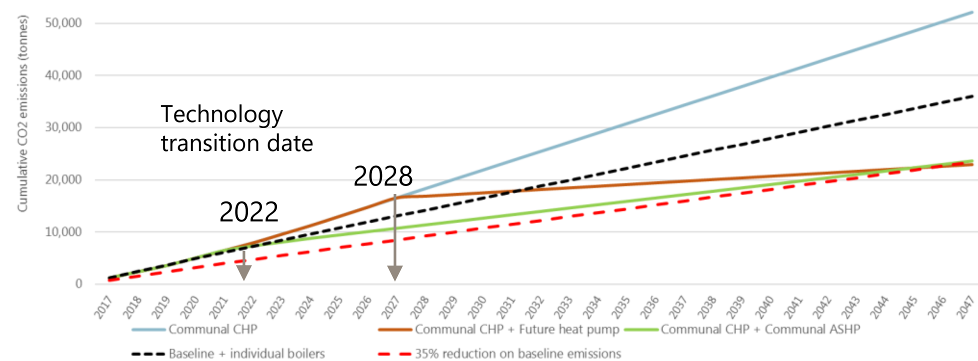
The cumulative carbon emission of each heat supply technology have also been considered.

Communal gas engine CHP significantly increases carbon emissions against communal boilers across a 30 year lifetime, whereas, despite electric systems having greater carbon emissions under Part L 2013, they are expected to provide greater than 35% reduction over the lifetime with BRE carbon factor projections.

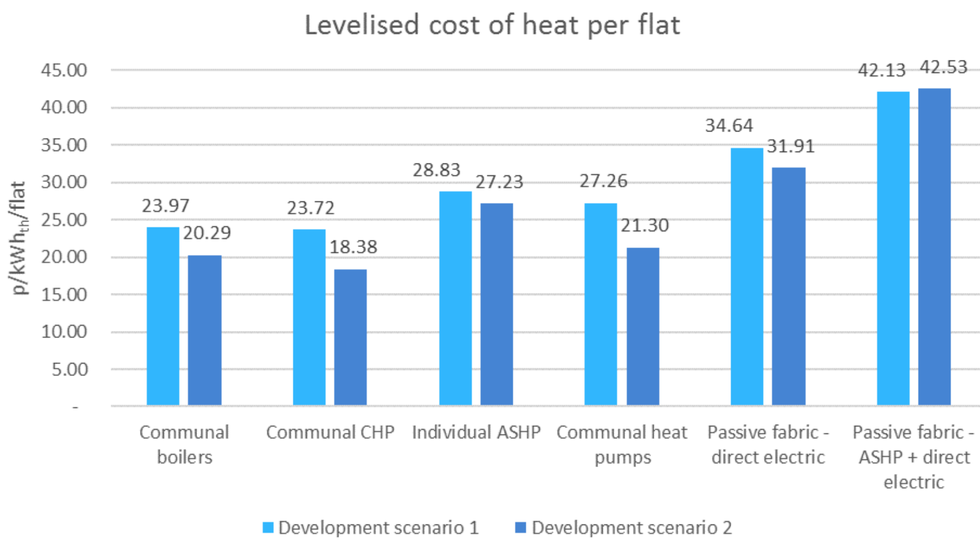
To reduce emissions in existing consented schemes that have gas engine CHP, at the time of plant replacement a lower carbon heat source should be used, such as:

- ASHPs by 2022 with a Seasonal Performance Factor (SPF) of 2.5
- Heat pumps from another environmental or waste heat source by 2028 with a SPF of 4.2





TECHNO-ECONOMIC ASSESSMENT:
LEVELISED COST OF HEAT



The levelised cost of heat is the cost of generating heat energy for a system or user. It is an economic assessment of the cost of the energy-generating system including all the costs over its lifetime, which includes CAPEX, operational and maintenance costs, cost of fuel, cost of replacement. The graph shows the Levelised cost of heat for each supply option and each development scenario.

The analysis shows that communal heating is cheaper per kWh of heat in a larger developments (scenario 2) and individual heat pump options always show an increase in CAPEX compared to gas engine CHP and communal systems.

Gas engine CHP is the only option that shows a reduced levelised cost of heat reduction compared with gas boilers. However, communal heat pumps in scenario 2 have a similar cost to communal boilers. Direct electric systems show high levelised cost due to the high cost of electricity in comparison to gas.

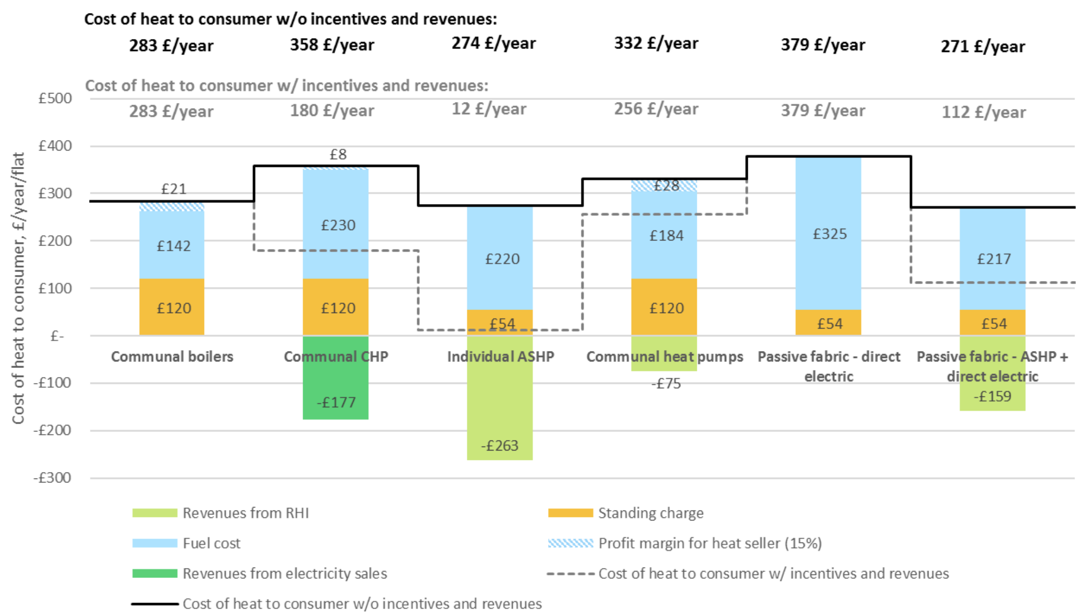
COST OF HEAT TO CONSUMERS

The graph shows the cost of heat to the consumer for each heat supply option for the small single block development. It shows the cost of heat with and without incentives or incoming revenue.

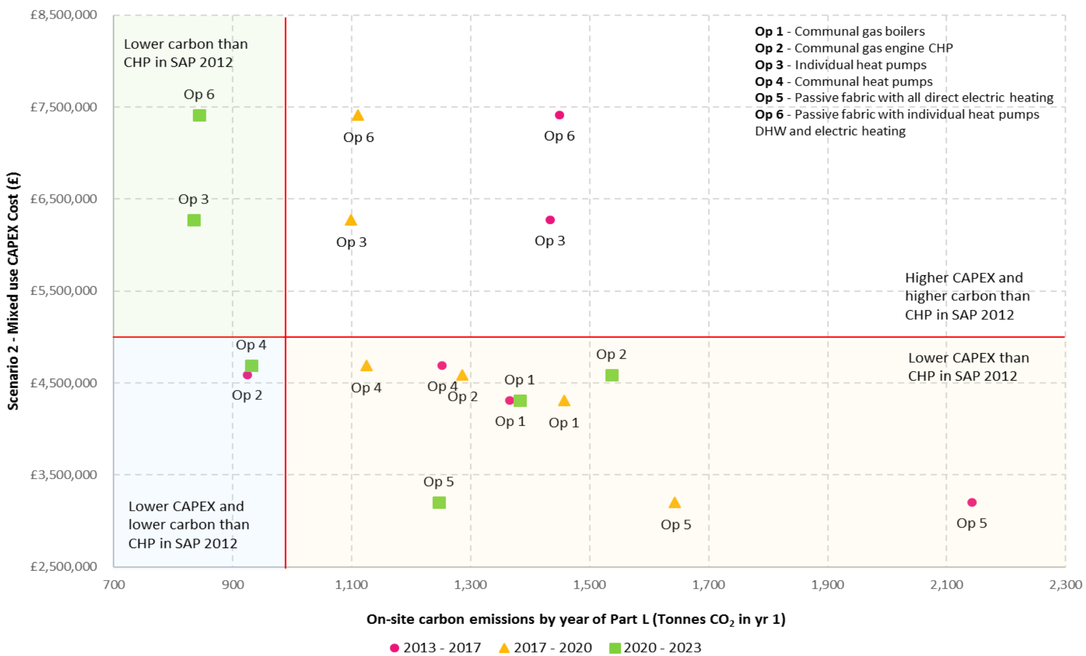
It shows that communal systems have comparable costs; gas engine CHP and heat pumps can be cheaper or equivalent to communal boilers if the revenues from incentives and electricity sales are passed on to the customer.

Individual ASHPs have nearly zero net fuel costs when Renewable Heat incentive (RHI) is available; however this only lasts for 7 years for residential dwellings under current government policy and without it, the costs are comparable to gas boilers.

Passive fabric with all direct electric systems have the greatest annual cost of heat to the consumer and are not eligible for any incentives.



INVESTMENT COST VS. CARBON



The graph shows the carbon emissions of each heat supply option under future expected iterations of Part L plotted against the capital cost to install them. It shows the results for the medium scale mixed used development. Regions have been created to show the comparison with gas engine CHP under SAP 2012, which has been shown to meet ~35% carbon reduction on site and to provide a benchmark of financial viability in many schemes across London.

Communal heat pumps shows equivalent carbon emissions to gas engine CHP, in 2013, with slightly increased CAPEX costs in 2019 onwards.

Individual heat pump options always show an increase in CAPEX but a reduction in carbon compared to gas engine CHP by 2019 onwards.

Passive Fabric with all direct electric heating show the lowest CAPEX of all the options, however show higher carbon emissions than all other options until 2019.

HOW TO FACILITATE HEAT NETWORKS AND LONG TERM CARBON REDUCTIONS GOING FORWARD

- The marginal development types chosen for the study, on a block/ single site level, are those that are key for connection to a localised DHN or area-wide DHN within a GLA opportunity area.
- For that reason it is important that these development types include communal heating and cooling systems for easy connection to DHNs that are available in the future, reducing the stumbling block for connection and mitigating replacement of individual dwelling plant.
- The follow will help facilitate DHNs and reduce carbon emissions going forward:
  - Demand reduction as a priority, reducing overall emissions, pipe sizing and therefore standing losses
  - Heat pump based district heat networks from a variety of heat sources
  - Reduction of flow and return temperature should be encouraged to reduce losses
  - Transition to lower carbon energy sources, such as environmental, waste heat and energy-from-waste will be key to arresting carbon emissions from gas engine CHP and natural gas. Accelerated replacement of gas engine CHP in existing or planned networks with communal heat pumps (as long as financially viable)
  - Allow for developments to install gas boiler only systems instead of gas engine CHP systems for extended periods of time, before DHN connection, to ensure developments are not locked into higher carbon scenarios with stranded assets.
- However, in locations where a DHN is not considered feasible, individual heat pump options will reduce overall cumulative carbon emissions in the long term. A technology-agnostic approach may be more appropriate to enable innovative and creative systems to achieve long term carbon goals. The cost implications and impacts on occupants energy bills should be strongly considered compared to a communal system even if a DHN is not imminently available.

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