MAYOR OF LONDON

Energy Assessment Guidance

Greater London Authority guidance on preparing energy assessments as part of planning applications (April 2020)

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Summary of guidance updates

The following updates have been made to the Energy Assessment Guidance:

- Section 1:
    a. Introduction of the 'be seen' policy applicable to all major developments with links to separate detailed guidance
    b. Introduction of the whole life cycle policy applicable to all referable applications with links to separate detailed guidance
    c. Reference to the London Plan energy hierarchy (Policy SI 2)
- Section 2: Further explanation setting out what is required for different types of planning application
- Section 5: Further explanation on when applicants will be expected to use SAP 10.0 carbon emission factors and when SAP 2012 will still be allowed
- Section 6:
    a. Further detail around the carbon calculating, reporting offsetting requirements
    b. A revised section on the requirements for refurbishments and an introduction of a section addressing modular buildings, temporary construction and co-living spaces
- Section 7: Further explanation around cost estimates
- Section 8:
    a. Replacing the GLA's Overheating Checklist with the Good Homes Alliance Early Stage Overheating Risk Tool, for preliminary stage overheating analysis
    b. Clarifying the GLA's position in cases where there are limitations on opening windows for ventilation purposes
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    e. Reiterating the importance and role of heat networks
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    g. Requirements related to the decarbonisation of heat networks
    h. Reference to the updated London Heat Map and requirement for developers to provide information to update the Heat Map
    i. Reference to ambient loop systems and their limitations when connection to district heat networks is viable
    j. More guidance introduced on best practice measures of heat network design
    k. Further clarity provided for schemes where a single energy centre may not be the most suitable solution
    l. More information provided around air quality limits and compliance requirements

- Section 10:
    a. Transfer of heat pump and photovoltaic (PV) requirements into the main body of the guidance due to the frequency with which these technologies are being put forward by applicants
    b. Further scrutiny of heat pump performance introduced through certain additional requirements
- Section 11: Introduction of the requirements from applicants to respond to the flexibility and peak demand related policies

Purpose of energy assessments

1. Introduction

1.1. The Mayor of London has declared a climate emergency and has set an ambition for London to be net zero-carbon. This means all new buildings must be net zero carbon. The Mayor's London Plan sets the targets and policies required to achieve this. It includes:

- a net zero-carbon target for all major developments, which has applied to major residential developments since 2016. This guidance document explains how to achieve this.
- a requirement for all major development to 'be seen' i.e. to monitor and report its energy performance post-construction to ensure that the actual carbon performance of the development is aligned with the Mayor's net zero carbon target. A separate guidance document[1] explains how to meet this requirement.
- a requirement for all referable planning applications to calculate and reduce whole life-cycle carbon emissions to fully capture a development's carbon impact. A separate guidance document[2] explains this requirement further.

1.2. This guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor[3] as set out in London Plan Policy SI 2. It is for anyone involved in, or with an interest in developing energy assessments including developers, energy consultants and local government officials. Although primarily aimed at strategic planning applications, London boroughs are encouraged to apply the same structure for energy assessments related to non-referable applications and adapt it for relevant scales of development.

1.3. The purpose of an energy assessment is to demonstrate that the proposed climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy. It also ensures energy remains an integral part of the development's design and evolution.

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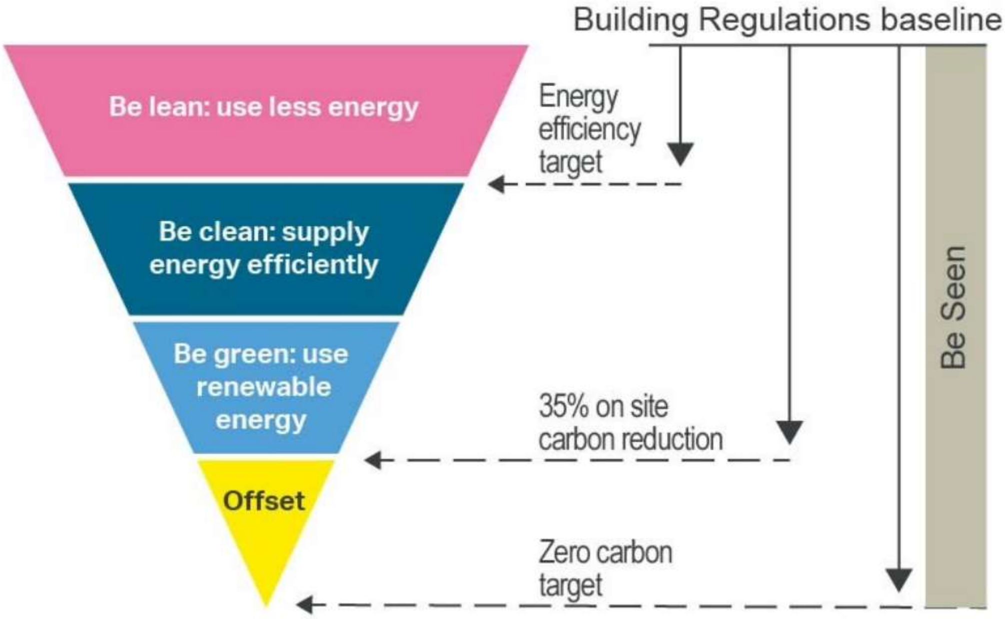
[1] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/planning-guidance/be-seen-energy-monitoring-guidance-pre-consultation-draft
[2] https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/planning-guidance/whole-life-cycle-carbon-assessments-guidance-pre-consultation-draft
[3] An application is referable to the Mayor if it meets the criteria set out in the Mayor of London Order (2008), which include development of 150 residential units or more, development over 30 metres in height (outside the City of London) or development on Green Belt or Metropolitan Open Land.

1.4. In line with the London Plan, major developments are expected to be net zero-carbon by incorporating a series of measures outlined in the following energy hierarchy:

- be lean: use less energy and manage demand during operation through fabric and servicing improvements and the incorporation of flexibility measures
- be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly by connecting to district heating networks
- be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
- be seen: monitor, verify and report on energy performance through the Mayor's post construction monitoring platform

Figure 1: *The London Plan energy hierarchy*



1.5. The energy assessment must fully comply with Policies SI 2 to SI 4 inclusive of the London Plan and, recognising the integrated nature of London Plan policies, take account of relevant design, spatial, air quality, transport and climate change adaptation policies in the Plan.

1.6. The energy assessment must clearly outline the applicant's commitments in terms of CO_2 savings and measures proposed to reduce energy demand. It is also important to consider and mitigate any potential air quality impacts arising as a result of the technologies proposed. Part 2 of this document provides guidance on details required within an energy assessment.

1.7. Each application is considered on its merits, taking into account the individual characteristics of the development. For all strategic planning applications case-specific energy comments for each development are provided at Stage 1 and 2 of the GLA planning process by GLA energy officers to ensure applications comply with London Plan policy. However, for the avoidance of doubt, energy assessments must:

- be submitted at the planning application stage, not submitted post planning in response to a condition
- report estimated site-wide regulated CO_2 emissions and reductions (broken down for the domestic and non-domestic elements of the development), expressed in tonnes per annum, after each stage of the energy hierarchy
- demonstrate how the net zero carbon target[4] for major domestic and non-domestic development will be met, with at least a 35% on-site reduction beyond Part L 2013 and proposals for making up the shortfall to achieve net zero carbon, where required
- commit to reducing regulated CO_2 emissions by 10 percent below those of a development compliant with Part L 2013 of the Building Regulations through energy efficiency measures alone, and by 15% for non-residential applications [5]
- include information demonstrating that the risk of overheating has been mitigated through the incorporation of passive design measures
- demonstrate that connection to existing or planned district heating networks has been prioritised and provide correspondence to support this
- commit to a communal heat network to allow connection to existing or planned district heating networks identified in the area
- minimise the number of energy centres and provide a single point of connection to the District Heating Network (DHN)
- investigate suitable low carbon and/or renewable heating plant for installation within the energy centre if connection can't be made to an area wide network
- investigate and commit to maximising the installation of renewable technologies (including the potential for storage) on site
- include information on how the building's actual energy performance will be monitored post-construction and report the energy and carbon performance on the GLA's online platform
- align with related documents and assessments that are submitted as part of the planning application, e.g. Whole Life-Cycle Carbon Assessments, Air Quality Assessments, Sustainability Statements

[4] The net zero carbon target applies to all major developments, e.g. those with 10 or more units and those with >1000m^2 of floorspace, not just those referred to the Mayor. Refer to the Mayoral Order 2008 for a full definition of a major development.

[5] Developments comprising both domestic and non-domestic uses must demonstrate this target has been achieved for domestic and non-domestic uses separately

2. Requirements for different types of planning application

2.1. When submitting a planning application, the applicant must clearly identify whether the proposal relates to an outline, full or hybrid planning application. These are defined in Table 1.

2.2. The energy requirements for each type of application are explained in the following sections.

Table 1: *Energy assessment guidance*

Type of application	Requirement
An outline planning application…	seeks to establish whether the scale and nature of a proposed development is acceptable in planning terms before a detailed 'reserved matters' application[6] is put forward.
A full planning application…	includes all of the detailed proposals of how a site can be developed which permission is based on.
A hybrid planning application…	seeks outline planning permission for one part of the site and full planning permission for another part of the same site.

Outline planning applications

2.3. All outline planning applications should be accompanied by an energy strategy which will guide the design of the development. While less detail will be expected than for a full planning application, applicants should undertake initial feasibility work on each part of the energy hierarchy to illustrate how they will minimise carbon emissions from the development.

2.4. Applicants should also consider the CO_2 targets that are likely to be in place at the time of submission of the reserved matters application to ensure that the scheme can meet any higher planning or regulatory targets. A similar approach will apply to Section 73 (s73) applications for the removal, variation or discharge of a condition on an approved scheme.

[6] Outline planning permission is granted subject to conditions requiring the subsequent approval of one or more 'reserved matters', i.e. matters which are reserved for later determination as defined in the Town and Country Planning (Development Management Procedure) (England) Order 2015.

2.5. The strategy provided as part of an outline planning application must include all requirements outlined under paragraph 1.7 as well as:

- the overheating checklist (Appendix 1), which should be developed with the design team. While some aspects relating to building design may not be applicable at this stage it is important that factors that influence the risk of overheating are understood for the proposed development and a response provided outlining the design intent (e.g. glazing ratio) to reduce the risk of overheating. Detailed overheating modelling is not expected for the outline application, but a commitment to undertaking dynamic overheating modelling for the reserved matters application in line with GLA guidance should be made.

- large-scale developments (e.g. mixed-use developments containing more than 1,000 homes) which may be the catalyst for an area wide network, must:
  - demonstrate that they have carried out a feasibility study exploring the inclusion of additional space within the energy centre and capacity within the communal heat network to supply heat to nearby developments and, where applicable, existing buildings
  - provide a feasibility assessment to ensure that whichever heating technology is used it is optimised to meet the domestic hot water and part of the space heating demand, thereby minimising CO_2 emissions

2.6. Outline planning permission is granted subject to ‘reserved matters’, i.e. aspects of a proposed development which are ‘reserved’ and will require subsequent approval as part of a reserved matters application. The local planning authority should therefore secure the key energy commitments in the strategy through appropriate clauses in the section 106 agreement[7] or through an appropriate planning condition.

2.7. When the reserved matters application is submitted, it should be accompanied by a detailed energy assessment which should demonstrate consistency with the outline strategy. See the following section for information on what an energy assessment submitted alongside a reserved matters planning application should include.

Full (and reserved matters) planning applications

2.8. Full (and reserved matters) planning applications must provide a detailed energy assessment which includes the information set out in paragraph 1.7 of this guidance.

[7] Planning obligations secured under Section 106 of the Town and Country Planning Act 1990 (as amended), commonly known as section 106 agreements, are a mechanism which make a development proposal acceptable in planning terms, that would not otherwise be acceptable.

2.9. Planning conditions and/or section 106 agreements should be used to secure the implementation of proposed measures. They must not be used to secure feasibility work that normally underpins a planning application as this will be too late in the process for feasibility work to influence the design of the development.

Hybrid planning applications

2.10. For hybrid applications, applicants should typically provide one strategy for the entire site with the design and expected CO_2 performance for the detailed and outline parts of the site presented separately, according to the requirements set out in the preceding sections.

3. Integration with supporting documents for planning applications

3.1. All planning applications referred to the Mayor must include an energy assessment prepared in accordance with this guidance document; however, where other supporting documents are being submitted as part of a planning application, it may be appropriate to cross-reference these documents, provided cross-referencing is clear and the documents contain sufficient information to allow an assessment of the application. Cross-referenced documents may include the following:

- Design and Access Statement
- Sustainability Statement
- BREEAM pre-assessment report (or equivalent e.g. LEED green building certification[8])
- Environmental Impact Assessment
- Air Quality Assessment (including evidence to show that the air quality assessment is consistent with the energy strategy)
- Whole-life Cycle Assessment
- Circular Economy Assessment
- Energy master plan for the area (where this exists).

It will also be expected that applicants will reference and use relevant guidance documents where appropriate, e.g. the London Heat Network Manual.

[8] Applicants should confirm the type of assessment with the local authority should non-traditional methodologies be followed.

Structure and content of energy assessments

4. Executive summary of the energy assessment

4.1. This must be a non-technical summary which provides a brief description of the proposed development. This must clearly state the number of each different type of residential unit (e.g. 450 flats and 70 houses), as well as the associated gross internal floor area. It should also summarise the floor area (m^2) allocated for different non-domestic uses.

4.2. It should set out and commit to the key measures and CO_2 reductions identified for each stage of the energy hierarchy. It must clearly indicate the performance of the domestic and non-domestic elements of the development in relation to the London Plan's net zero-carbon target for all new major developments.

4.3. For referable applications, the executive summary should confirm which emission factors are being used. See section 5 for detail on the carbon emission factors.

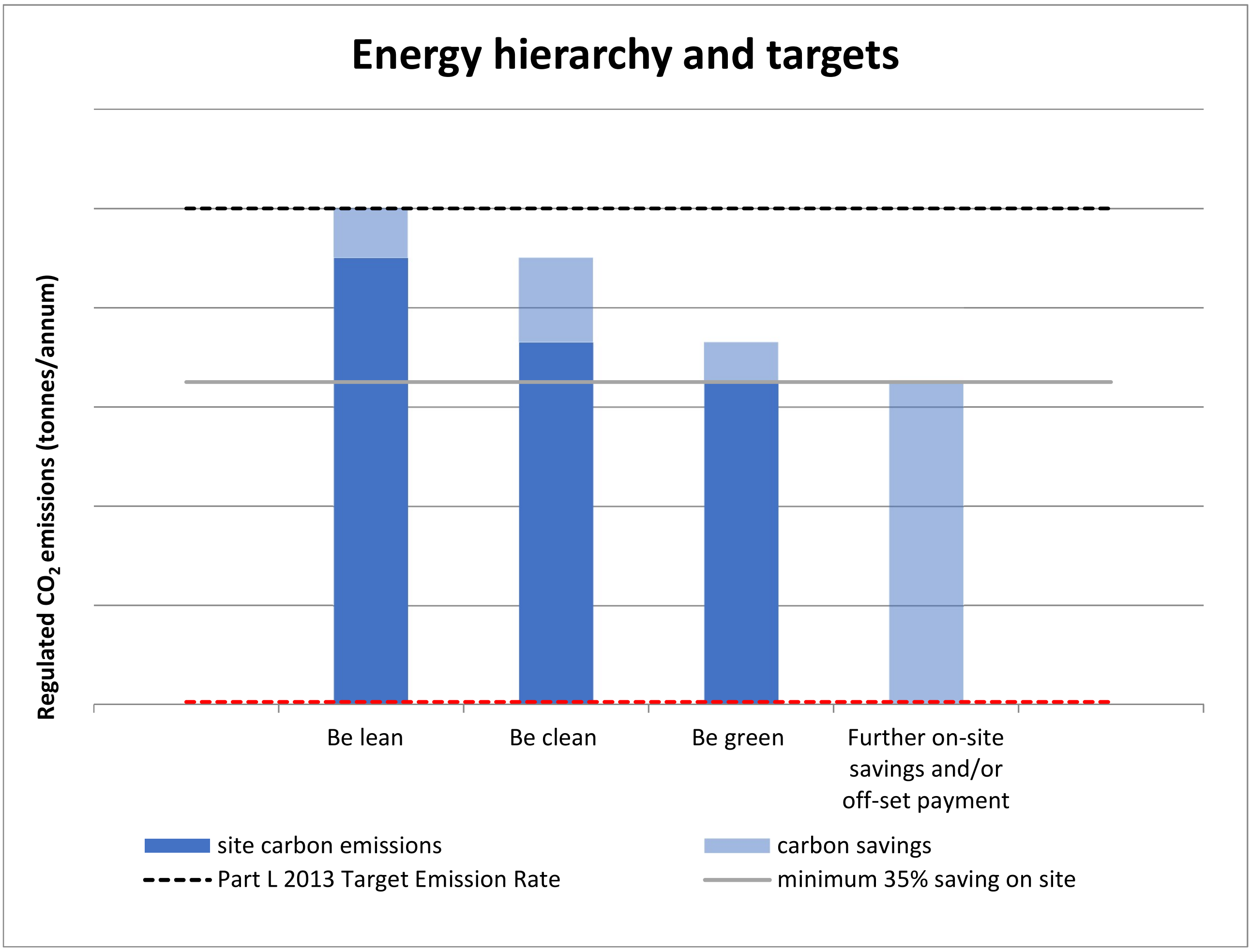
4.4. The regulated carbon dioxide emissions reduction target for major domestic and non-domestic development is net zero carbon, with at least a 35% on-site reduction beyond Part L 2013 of the Building Regulations.

4.5. Where it has been fully evidenced that the on-site carbon reductions have been maximised, the application is required to ensure the shortfall is met via a payment made into the borough's carbon offset fund or is met off-site in agreement with the relevant borough (see Tables 2 and 3 for calculations to determine the shortfall). Refer to the GLA's Carbon Offset Fund guidance for further information on carbon offsetting[9].

4.6. The concept of applying the energy hierarchy in relation to Part L 2013 of the Building Regulations is illustrated in Figures 1 and 2 below. Where the blue bars drop below the black dotted line, this demonstrates savings in regulated CO_2 emissions compared to a development that complies with Part L 2013 of the Building Regulations. In the example provided the development exceeds Building Regulations compliance through energy efficiency alone, with further reductions achieved through heat networks and renewable energy to comply with the London Plan target.

[9] https://www.london.gov.uk/sites/default/files/carbon_offsett_funds_guidance_2018.pdf

Figure 2: *Worked example of savings anticipated from the London Plan energy hierarchy*



5. Carbon emission factors

Which carbon emission factors should be used?

5.1. It is expected that SAP 10.0[10] emission factors will be used for referable applications unless the application:

- is in a Heat Network Priority Area**; and**
- there is potential to connect to an existing network using gas-engine CHP or a **new network using low-emission CHP**

5.2. If both of these criteria are met, then SAP 2012 emission factors may be used provided the heat network operator has, or is in the process of developing, a strategy to decarbonise the network and has shared it with the GLA. This is in line with the London Plan heating hierarchy (Policy **SI 3 D.**)**, which states that the priority is for new developments to connect to local existing or planned district heat networks**

5.3. If the application is a non-referable development, then it will be down to the borough's discretion to decide which emission factors are used.

5.4. Since January 2019, applicants submitting referable applications have been encouraged to use the SAP 10.0 emission factors in areas where there are **no** opportunities to connect to existing or planned district heat networks. This approach will remain in place until national government updates building regulations, so that new development better reflects the actual carbon emissions associated with their operation.

5.5. For developments where there **is** an opportunity to connect to existing heat networks using gas-engine CHP, or new heat networks using low emission CHP, SAP 2012 emission factors may be used provided the heat network operator has, or is in the process of developing, a strategy to decarbonise the network and has shared it with the GLA. This is in line with the London Plan heating hierarchy (Policy SI 3 D), which states that the priority is for new developments to connect to local existing or planned district heat networks.

5.6. Applicants using SAP 10.0 emission factors should continue to use the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements (as outlined in Section 6), but with the outputs manually

[10] Until the formal adoption of the new Building Regulations, applicants will be expected to use the SAP 10.0 carbon emission factors for all applications. The use of the SAP 10.1 carbon emission factors will not be accepted. These are part of a broader set of changes to Part L that are being consulted on and aren't expected to be adopted until Autumn 2020. Once government has made its final decisions on the new Part L the GLA will confirm how these changes will be applied in London.

converted for the SAP 10.0 emission factors[11]. A spreadsheet has been developed for this purpose which applicants should provide as part of their energy assessment[12]. This spreadsheet should be used to record the estimated carbon performance of the development using SAP 10.0 and SAP 2012 emission factors to allow for a robust assessment of performance against the new emission factors and comparison against the old emission factors.

5.7. Applications using SAP 10.0 emission factors should be conditioned to achieve the carbon reductions calculated using SAP 10.0 emission factors. The version of emission factors being applied should be clearly stated in the condition wording. It should be noted that the use of the SAP 10.0 emission factors in this context is for demonstrating performance against planning policy targets and, as such, is separate to Building Regulation compliance. Applications should therefore ensure that compliance with Building Regulations is maintained.

5.8. The London Plan limits the role of CHP to low-emission CHP and only in instances where it can support the delivery of an area-wide heat network at large, strategic sites. Applicants proposing to use low-emission CHP will be asked to provide sufficient information to justify its use, ensure that the carbon and air quality impact is minimised, for example through the selection of a lower emission unit and use of abatement technology, and undertake emissions testing to demonstrate that the installed system meets emission limits prior to occupation. See Appendix 2 for further information on the use of CHP and the air quality information required if it is proposed.

5.9. Regardless of which emission factors are used, applicants will continue to be expected to meet the GLA's minimum carbon reduction targets and to maximise opportunities for carbon reductions from all stages of the energy hierarchy. All applicants should refer to Appendix 3 for guidance on the information required for the technology (or technologies) being proposed.

[11] At the time of publication there is no official government approved software for the SAP 10 methodology, apart from the BRE's test software which is expected to undergo further adjustments ahead of consultation on its official adoption.

[12] https://www.london.gov.uk/what-we-do/planning/planning-applications-and-decisions/pre-planning-application-meeting-service-0

6. Establishing CO_2 emissions

6.1. The energy assessment must clearly identify the carbon footprint of the development after each stage of the energy hierarchy.

6.2. The following tables should be completed and presented separately for domestic uses, non-domestic uses and the entire site, to demonstrate compliance with the energy hierarchy and the carbon targets. Savings are to be expressed in tonnes of CO_2 per annum, not $kgCO_2/m_2$ per annum. The calculation of unregulated carbon emissions should be done as part of the compliance with the 'be seen' policy and associated guidance.

Table 2: *The London Plan energy hierarchy*

	Carbon dioxide emissions (tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	A	
After energy demand reduction (be lean)	B	
After heat network connection (be clean)	C	
After renewable energy (be green)	D	

Table 3*: Regulated carbon dioxide savings from each stage of the energy hierarchy*

	Regulated carbon dioxide savings	
	(tonnes CO_2 per annum)	**(%)**
Be lean: Savings from energy demand reduction	A – B	(A – B)/A * 100
Be clean: Savings from heat network	B- C	(B – C)/A * 100
Be green: Savings from renewable energy	C – D	(C – D)/A*100
Cumulative on-site savings	A - D = E	(A – D)/A*100
Carbon shortfall	A - E = F	
	(tonnes CO_2)	
Cumulative savings for offset payment	F * 30 years = G	
Cash-in-lieu contribution	G * carbon dioxide offset price = H	

Carbon offsetting

6.3. If the net zero-carbon target cannot be met on site and the GLA is satisfied that on-site savings have been maximised, then the annual remaining carbon emissions figure is multiplied by the assumed lifetime of the development's services (e.g. 30 years) to give the cumulative shortfall. The cumulative shortfall is multiplied by the carbon dioxide offset price to determine the required cash-in-lieu contribution. Boroughs are expected to use the recommended carbon offset price of £95 per tonne of carbon dioxide[13], or to set their own based on local viability evidence.

[13] The Mayor's London Plan Viability Study assumes a carbon offset price of £95 per tonne of carbon dioxide for a period of 30 years. The GLA will regularly review the recommended carbon offset price.

6.4. The applicant should confirm in the energy assessment the value of the offset payment which will be made to the borough. Alternatively, boroughs may agree that the developer can directly offset any shortfall in carbon dioxide reductions from a development by installing carbon dioxide saving measures off-site, e.g. photovoltaic panels on a local school. If this approach is being used then this should be confirmed in the energy assessment along with evidence of discussions with the borough's energy officer and following the guidance provided in the GLA's Carbon Offset Fund Guidance. The boroughs should secure this through legal agreements with the applicant. The GLA's Carbon Offset Funds guidance also provides advice for boroughs on establishing carbon offset funds and how to identify suitable projects for funding[14].

6.5. A cash in lieu payment should not be used as a cost comparison with delivering CO_2 savings on-site. Policy SI 2 requires carbon reductions to be achieved as far as possible on-site and a cash in lieu contribution will be considered acceptable only in instances where it has been clearly demonstrated that no further savings can be achieved on-site.

6.6. The Mayor's Housing Standard's London Plan Viability Assessment Study[15] assumes a carbon offset price of £95 per tonne of carbon dioxide for a period of 30 years. Boroughs are expected to use this price or to set their own based on local viability evidence by undertaking a locally specific viability assessment. The GLA will regularly review the recommended carbon offset price.

Calculating regulated CO_2 emissions for a Part L 2013 of the Building Regulations compliant development

6.7. The energy assessment must first establish the regulated CO_2 emissions assuming the development complied with Part L 2013 of the Building Regulations using Building Regulations approved compliance software (see references to SAP and SBEM below). When determining this baseline, it should be assumed that any heating and hot water supply would be provided by gas boilers and that any active cooling would be provided by electrically powered equipment. If a communal heating system is being proposed, this should be included when determining CO_2 emissions to ensure a consistent baseline (i.e. the energy supply for a large apartment block would be provided by communal gas boilers not individual ones in each dwelling).

6.8. For each non-domestic building the Target Emissions Rate (TER) should be multiplied by its floor area to provide the related regulated CO_2 emissions. For each representative dwelling type, the related TER is multiplied by the cumulative floor area for that dwelling type to establish the related CO_2 emissions. The CO_2

[14] https://www.london.gov.uk/sites/default/files/carbon_offsett_funds_guidance_2018.pdf
[15] https://www.london.gov.uk/sites/default/files/london_plan_viability_study_technical_report_dec_2017.pdf

emissions for each non-domestic building and dwelling type are then summed to give the total regulated emissions for the development.

6.9. As shown in Tables 2 and 3, the total regulated emissions must be multiplied by the percentage target (divided by 100) to give the aggregate target reduction in the development's tonnes of regulated CO_2 emissions.

Calculating regulated CO_2 emissions at each stage of the energy hierarchy

6.10. Regulated emissions, which include the energy consumed in the operation of the space heating/cooling and hot-water systems, ventilation and internal lighting, must be calculated.

6.11. Regulated emissions must establish:

- **Dwellings**: a Dwelling CO_2 Emissions Rate (DER) calculated through the Part L 2013 of the Building Regulations methodology SAP 2012. This is multiplied by the cumulative floor area for the particular dwelling type in question to give the related CO_2 emissions. In terms of the extent of modelling work required, the applicant must provide information for a representative sample of domestic properties.
- **Non-domestic**: a Building CO_2 Emissions Rate (BER) calculated through the Part L 2013 of the Building Regulations methodology based on the National Calculation Methodology (NCM) and implemented through Simplified Building Energy Model (SBEM) v5.2d or later or equivalent software[16]. For each building, the related BER is multiplied by its floor area to give the related carbon dioxide emissions.

6.12. A summary of the modelling work output (i.e. BRUKL reports, DER worksheet for dwellings) must be provided in an appendix of the energy assessment for each stage of the energy hierarchy.

6.13. The CO_2 emissions for each non-domestic building should be summed together to give total non-domestic regulated emissions. Similarly, the CO_2 emissions of all dwellings must then be summed to give the total regulated emissions for the domestic element of the development. These figures should be expressed in tonnes per annum.

6.14. After calculating the regulated emissions at each stage of the energy hierarchy, the percentage savings in regulated emissions over a Part L 2013 of the Building Regulations compliant development must be provided (as shown in the tables

[16] Other building regulation compliance software such as IES or TAS is also acceptable.

above) for the domestic and non-domestic elements of the development and for the site as a whole.

Calculating regulated CO_2 emissions for refurbishments

6.15. Where an existing building or group of buildings is refurbished and the development qualifies as a major refurbishment[17], applicants are required to provide an energy assessment demonstrating how the individual elements of the energy hierarchy have been implemented and how reductions in regulated CO_2 emissions have been achieved.

6.16. The following section outlines the approach applicants should take when estimating improvements in CO_2 emissions for existing buildings and change of use applications. For non-referable applications, applicants should liaise with the respective borough on any local requirements for existing buildings in relation to demonstrating CO_2 emission performance.

Baseline

6.17. Where major refurbishments are being carried out an estimate of the CO_2 savings from the refurbishment of the building will be expected. To provide this, applicants are required to estimate the CO_2 emission baseline performance of the existing building using Building Regulations approved compliance software.

6.18. Applicants are required to generate baseline CO_2 emissions assuming the notional specification for existing buildings, shown in Appendix 4, and which is based on Approved Documents L1B and L2B as well as the Government's Building Services Compliance Guidance. This will provide a consistent baseline across all refurbishments and clearly distinguish the improvements in CO_2 emissions that are over and above what would ordinarily be undertaken through meeting Building Regulation requirements.

6.19. There will be instances where the energy performance of existing elements is more efficient than the Notional Specification for Existing Buildings. In this case the actual energy performance of the building element should be used rather than the Notional Specification for Existing Buildings with supporting evidence i.e. a building condition survey, Energy Performance Certificate (EPC) conventions etc.

6.20. For change of use applications, the Part L model for estimating CO_2 emissions should use the same Building Use Class for the baseline as for the proposed development. In some circumstances, most frequently in change of use applications, it is possible that the existing building does not include certain

[17] Major refurbishments are those which comprise of 10 or more units and, for other uses, those with have a floorspace of 1000m^2 or more.

building elements that should be included in the baseline. In this case it is expected that the estimate of the performance of the building element would meet the notional specification for existing buildings, shown in Appendix 4.

CO_2 emission improvements

6.21. Once the baseline has been established, applicants will be expected to demonstrate that they have incorporated improvement measures that maximise performance at each stage of the energy hierarchy.

6.22. The BER/DER of the refurbished building should be determined following improvements at each stage of the energy hierarchy using Building Regulations compliance software. These figures should then be used to report the CO_2 savings at each stage of the energy hierarchy in the format of Tables 2 and 3 above and included in the energy assessment.

6.23. The performance values used to calculate the CO_2 emission improvements at each stage of the energy hierarchy should also be outlined. In addition, confirmation should be provided of the source of the assumptions for the improvements in building elements or services, including specific U-value calculations for proposed build-ups, manufacturer's datasheet etc.

6.24. The developer is required to report how the proposed improvement measures compare with the notional specification for existing buildings in Appendix 4. To meet the GLA's carbon reduction target it is expected that applicants will exceed these standards. It is acknowledged that the Approved Documents allow for flexibility in meeting the recommended standards due to potential restrictions to building work upgrades, for instance listed building status or heritage projects. Therefore, any limitations in meeting these recommended standards should be stated.

6.25. It is generally acknowledged that the level of carbon savings that can be achieved through a refurbishment can vary considerably, however every effort should be made to improve the energy performance of the building in line with London Plan carbon targets and to follow the energy hierarchy.

Extensions

6.26. For developments consisting of a refurbishment with a new build extension, the CO_2 savings for the new and refurbished elements should be presented separately within the energy strategy. The new build elements should be assessed in line with the methodology for new build development and will be expected to comply with London Plan policy.

Modular buildings, temporary construction and co-living spaces

6.27. Modular buildings will be expected to comply with the London Plan policies. As with any planning application, applicants should submit an energy strategy demonstrating that the energy hierarchy has been followed and demonstrating how carbon emissions are being reduced at each stage. The measures that will be undertaken to mitigate the overheating risk should also be outlined. The nature of modular building means that they will be expected to demonstrate high standards of energy efficiency while maximising on-site renewable energy opportunities.

6.28. For temporary construction, applicants will be expected to maximise carbon savings in line with the London Plan policies. Applicants should provide evidence relating to the lifespan of the building and an explanation of the expected use of the building once the temporary planning permission period has expired. This will inform how the policy will be applied to these applications and will be established on a case by case basis.

6.29. Developments comprising co-living spaces will be treated as residential uses for the purposes of complying with London Plan Policy H 16. It will therefore be expected that Part L 1 modelling methodology is carried out.

7. Demand reduction (Be Lean)

7.1. All applications referred to the Mayor are expected to achieve the Policy SI 2 energy efficiency targets in the London Plan:

- Domestic developments should achieve at least a **10%** improvement on Building Regulations from energy efficiency

- Non-domestic developments should achieve at least a **15%** improvement on Building Regulations from energy efficiency.

7.2. Energy assessments must set out the demand reduction measures which will be put in place to achieve these targets. Measures typically include both architectural and building fabric measures (passive design) and energy efficient services (active design). Demand reduction features should be introduced at the earliest design stage of a development.

7.3. For residential developments, the total Part L Fabric Energy Efficiency Standard (FEES)[18] for the development as a whole should be provided.

Demonstrating CO_2 savings from demand reduction measures

7.4. Passive design measures, including optimising orientation and site layout, natural ventilation and lighting, thermal mass and solar shading, should be set out in the Design and Access Statement and cross-referenced in the energy assessment. Active design measures, including high efficiency lighting, efficient mechanical ventilation with heat recovery and waste water heat recovery, must also be investigated and set out in the energy assessment.

7.5. The applicant must provide details in the energy assessment of the demand reduction measures specific to the development, for example enhanced U-value numbers (W/m^2K), air tightness improvement, efficient services and lighting. Information should also be provided on the development's approach to limiting thermal bridges. Where a particular energy efficiency standard is to be met, this must be clearly stated. The glazing percentage of the buildings, expressed as the glazed area[19] divided by the façade area (multiplied by 100), should be clearly stated within the energy assessment.

7.6. The applicant must clearly identify the extent to which Part L 2013 of the Building Regulations is exceeded through the use of these demand reduction measures alone, i.e. the percentage improvement of the BER/DER over the Target CO_2

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[18] The FEES is the maximum energy demand for the dwelling.
[19] From the inside looking out.

Emissions Rate (TER)[20] before the inclusion of a heat network connection and use of on-site renewables.

7.7. The appendix of the energy assessment must include a summary output sheet from the modelling work (i.e. a print out such as a full BRUKL report) only taking into account energy efficiency measures, i.e. excluding the proposed heating system and renewable energy. The 'be lean' case should assume that the heating is provided by gas boilers and that any active cooling would be provided by electrically powered equipment.

7.8. If the final heating proposal is to be low carbon or renewable energy, gas boilers must still be assumed for the purposes of the 'be lean' element of the hierarchy. The distribution loss factor to be applied at the 'be lean' stage is the SAP default (1.05).

7.9. For applications that have a high domestic hot water demand, the potential for waste water heat recovery should be considered. Applicants proposing waste water heat recovery for domestic units should include the system in the SAP calculations. Applicants proposing waste water heat recovery for non-domestic units are not currently able to account for this using the Building Regulations methodology; they can however provide documentary evidence confirming the percentage of the hot water demand that this technology offsets. For both domestic and non-domestic proposals, evidence should be provided, including manufacturers datasheets or correspondence, to demonstrate that the performance claimed is achievable.

7.10. For applications that include residential units, a clear explanation of the different dwelling types modelled should be provided. For each dwelling type the full DER worksheet, including the effect of energy efficiency measures alone (i.e. excluding any contribution from the proposed heating system and renewable energy), should be provided, together with the full TER worksheet. It is essential that the worksheets containing the DER and TER and the modelling inputs are provided to enable the savings from energy efficiency to be validated (i.e. SAP worksheets or Part L compliance checklists alone are not sufficient as they do not include all the relevant information).

7.11. For applications including shell and core elements, the energy efficiency performance of building services should be considered to have the same potential for improvement as for other types of applications. Applicants are encouraged to develop a green lease agreement that tenants will be required to conform to, and which will secure the building services performance assumed.

[20] The Target CO_2 Emissions Rate is the minimum energy performance requirement for a new dwelling/building. It is expressed in terms of $kgCO_2$ per m^2 of floor area per year.

7.12. For residential developments, the total Part L Fabric Energy Efficiency Standard (FEES) for the development as a whole should be provided. The template in Table 4 should be completed, as included in the GLA's carbon emission spreadsheet.

Table 4: *Template for reporting FEES*

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement (%)
Development total			

Costs to occupants

7.13. Applicants will be expected to consider the estimated costs to occupants of the energy assessment and outline how they are committed to protecting the consumer from high prices. In line with the energy hierarchy, applicants should prioritise energy demand reduction. Energy efficiency measures should therefore be the primary factor of consideration before proceeding with a selection of the energy system.

7.14. The process to be followed as part of the 'be seen' post construction monitoring requirement is another critical element of the energy hierarchy that will play an important role in keeping running costs low.

7.15. Appropriate quality assurance mechanisms and commitments that should be considered as part of the energy strategy include:

- Gaining quality assurance accreditation (e.g. Heat Trust)
- Following quality standards (e.g. CIBSE Code of Practice)
- Transparent billing, including separation of the ongoing maintenance and capital replacement aspects of the standing charge
- Aftercare support (e.g. BREEAM Man 05 Aftercare)
- Heat tariffs options given to occupants
- Consumer choice for metering arrangements at no extra cost (e.g. Prepayment Meters (PPM))
- Thermal storage linked to pricing signals and renewable generation

7.16. When estimating the costs to occupants, applicants should consider all of the following parameters:

- Fuel used (including taxes, CCL etc.)
- Incentives (if applicable)
- Electricity sales (if applicable)
- Plant replacement
- Overheads
- Maintenance

8. Cooling and overheating

8.1. It is important to identify potential overheating risk in residential accommodation early on in the design process and then incorporate suitable passive measures within the building envelope and services design to mitigate overheating and reduce cooling demand in line with London Plan Policy SI 4.

The cooling hierarchy

8.2. Applicants should apply the cooling hierarchy in Policy SI 4 of the London Plan to the development. Whilst the cooling hierarchy applies to major developments, the principles can also be applied to minor development. Measures that are proposed to reduce the demand for cooling should be set out under the following categories:

1. Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure. It is also expected that external shading will form part of major proposals.

2. Minimise internal heat generation through energy efficient design: For example, heat distribution infrastructure within buildings should be designed to minimise pipe lengths, particularly lateral pipework in corridors of apartment blocks, and adopting pipe configurations which minimise heat loss e.g. twin pipes.

3. Manage the heat within the building through exposed internal thermal mass and high ceilings: Increasing the amount of exposed thermal mass can help to absorb excess heat within the building. Efficient thermal mass should be coupled with night time purge ventilation.

4. Provide passive ventilation: For example, through the use of openable windows, shallow floorplates, dual aspect units or designing in the 'stack effect' where possible.

5. Provide mechanical ventilation: Mechanical ventilation can be used to make use of 'free cooling' where the outside air temperature is below that in the building during summer months. This will require a by-pass on the heat recovery system for summer mode operation.

6. Provide active cooling systems: The increased use of air conditioning systems is generally not supported, as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. However, once passive measures have been prioritised if there is still a need for active cooling systems, such as air conditioning systems, these should be designed in a very efficient way and should aim to reuse the waste heat they produce.

Overheating risk analysis

8.3. All developments are required to undertake a detailed analysis of the risk of overheating. See the requirements set out in Table 5.

8.4. It is important to identify potential overheating risk in residential accommodation early on in the design process and then incorporate suitable passive measures within the building envelope and services design to mitigate overheating and reduce cooling demand in line with London Plan Policy SI 4.

Table 5*: GLA overheating requirements*

Domestic developments	Non-domestic developments
Pre-application stage	
Complete the Good Homes Alliance (GHA) Early Stage Overheating Risk Tool and submit it to the GLA as part of the preliminary energy information for the development. More information on the GHA tool can be found in Appendix 1.	Outline in the preliminary strategy information submitted to the GLA how the overheating risk will be minimised.
Stage 1	
Include the GHA Early Stage Overheating Risk Tool in the energy assessment.	N/A
Undertake dynamic overheating modelling in line with the guidance and data sets in CIBSE TM59 and TM49 respectively	Undertake dynamic overheating modelling in line with the guidance and data sets in CIBSE TM52 and TM49 respectively
Provide evidence of how the development performs against the overheating criteria along with an outline of the assumptions made in the energy assessment.	
Stage 2 onwards	
Ensure that the results of the overheating analysis continue to be incorporated into the building design discussions as the design evolves. Any substantive changes from Stage 1 proposals will require revised overheating analysis.	

8.5. At Stage 1 the following assumptions should be clearly reported within the overheating assessment:

- Dynamic overheating analysis software used
- Site location
- Site orientation
- Weather file used
- Internal gains
- Occupancy profiles
- Thermal elements performance (U-values and glazing g-values)
- Shading features (i.e. blinds, overhangs etc.)
- Thermal mass details
- Ventilation strategy
- Model images indicating the sample units modelled
- Units' internal layout

Specific provisions for domestic developments

8.6. For all domestic dynamic overheating analyses, applicants should additionally adhere to the following guidelines:

- Communal heating systems: Heat losses from pipework and heat interface units (HIUs) should be included within the model for all community heating systems.
- Communal corridors: Communal corridors should be included in the overheating analysis where community heating pipework runs through them. Paragraph 3.9 of the new CIBSE TM59 guidance describes the relevant methodology.
- Internal Blinds: Reliance on internal blinds to obtain a pass in the overheating analysis should be avoided as they can interfere with the effective opening area of windows (i.e. create a barrier for airflow) and are reliant on occupant behaviour. Where blinds are used to enable a pass, the results without blinds should also be presented as these could hinder any natural ventilation strategy. Where blinds are required to enable a pass the applicant should confirm that they will be included in the base build and demonstrate that any reduction in free area of open windows due to blinds has been taken into account in the model.
- Occupancy: CIBSE includes different levels of comfort target depending on the occupancy. Thermal comfort Category II, in line with CIBSE TM52, should be used by default for the associated acceptable temperature range. Category I should be used for instances of vulnerable residents.
- Limitations on openable windows: In instances where air quality or noise concerns pose limitations to the opening of windows, applicants will be required to submit two separate overheating analyses; one with openable windows and one with closed windows. This will ensure that passive measures have been

maximised and the façade design has been optimised regardless of the constraints posed by the site's location. Applicants should demonstrate that the assumptions of the overheating model are aligned with the noise and air quality assessments. Applicants are encouraged to refer to relevant published guidance which draws together these areas including the *Acoustics, Ventilation and Overheating Residential Design Guide*[21] (January 2020).

Using the CIBSE guidance

Non-domestic

8.7. CIBSE guide TM52, entitled 'The Limits of Thermal Comfort: Avoiding Overheating in European Buildings', contains guidance on the limits of thermal comfort. The TM provides guidance on predicting overheating in buildings. It is intended to inform designers, developers and others responsible for defining the indoor environment in buildings and should be considered when carrying out dynamic thermal modelling.

Residential (including care homes and student accommodation)

8.8. In 2017, CIBSE published the Design Methodology for the Assessment of Overheating Risk in Homes (TM59: 2017). This guide aims to provide a standardised approach to predicting overheating risk for residential building designs (new-build or major refurbishment) using dynamic thermal analysis.

8.9. The TM59 guidance methodology provides a baseline for all domestic overheating risk assessments. Section 3 of the methodology includes guidance on assumptions for sample sizes, openings, ventilation etc. Section 5 of the guidance document outlines the assumptions to be used for the internal gains including occupancy profiles. Whilst all homes will be occupied and operated differently, the methodology has been developed to ensure that the units tested will perform reasonably throughout the day and night. Therefore, the applicant must ensure that the assumptions for the overheating assessment follow the guidance within Section 3 & 5.

Design weather files

8.10. In 2014 the CIBSE, working in conjunction with the GLA, published: Design Summer Years for London (TM49: 2014)[22]. This guide aims to provide a risk-based approach to help developers and their advisers simultaneously address the challenges of developing in an urban heat island and managing an uncertain future climate. It provides guidance to help ensure that new developments are better designed for the climate they will experience over their design life.

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[21] https://www.association-of-noise-consultants.co.uk/wp-content/uploads/2019/12/ANC-AVO-Residential-Design-Guide-January-2020-v1.0.pdf
[22] http://www.cibse.org/knowledge/cibse-tm/tm49-design-summer-years-for-london-new-2014

8.11. Overheating modelling for both domestic and non-domestic developments should be conducted using the following design weather file:

- DSY1 (Design Summer Year) for the 2020s, high emissions, 50% percentile scenario

8.12. It is expected that the CIBSE compliance criteria is met for the DSY1 weather scenario.

8.13. Additional testing should be undertaken using the 2020 versions of the following more extreme design weather years:

- DSY2 – 2003: a year with a very intense single warm spell.
- DSY3 – 1976: a year with a prolonged period of sustained warmth.

8.14. It is acknowledged that meeting the CIBSE compliance criteria is challenging for the DSY 2 & 3 weather files, although it is expected that in the majority of cases a significant proportion of spaces will be able to achieve compliance if passive measures are fully exploited. Where the CIBSE compliance criteria is not met for a particular weather file the applicant must demonstrate that the risk of overheating has been reduced as far as practical and that all passive measures have been explored, including reduced glazing and increased external shading. The applicant should also outline a strategy for residents to cope in extreme weather events, e.g. use of fans, and they should commit to providing guidance to residents on reducing the overheating risk in their home in line with the cooling hierarchy.

Location weather data

8.15. To enable the urban heat island effect in the locality of the development to be taken into account, weather year data for three different locations are provided in the CIBSE TM49 guide - this data has been adjusted to take account of future climate effects. The most representative weather data set for the project location should be used, as presented below.

- London Weather Centre data: the Central Activity Zone (CAZ) and other high density urban areas (e.g. Canary Wharf).
- London Heathrow airport data: lower density urban and suburban areas.
- Gatwick Airport data: rural and peri-urban areas around the edge of London.

Exceptions to the overheating requirements

8.16. It is expected that dynamic thermal modelling of the overheating risk will be undertaken to support the energy assessment, unless the applicant can demonstrate exceptional circumstances where opportunities for reducing cooling demands via passive measures are constrained, for example:

- Industrial buildings including warehouses used for storage purposes;
- Supermarkets;
- Cinemas;
- Laboratories;
- Railway Station Extensions;
- Sports buildings with limited occupancy patterns;
- Temporary structures;
- Small retail food outlets where doors remain open to allow customer access.

8.17. In each of these cases applicants should demonstrate that the cooling demand has been minimised in line with the cooling hierarchy of London Plan Policy SI 4.

Active cooling

8.18. 'Active cooling' should not be specified in developments where it has been demonstrated that the passive or other measures proposed have successfully addressed the risk of overheating; to avoid unnecessarily increasing a development's energy demand and carbon emissions. In addition, it is not expected that 'active cooling' will be proposed for any residential developments.

8.19. Where design measures and the use of natural and/or mechanical ventilation are not enough to guarantee the occupants' comfort (in line with the cooling hierarchy set out in London Plan Policy SI 4), the developer should identify the cooling requirement of the different elements of the development in the energy assessment. Please note that this is the space cooling requirement, not the energy used by the equipment providing the cooling, i.e. it is not the electricity used by the electric chiller plant but the cooling energy supplied by the chiller.

Non-domestic development

8.20. For non-domestic buildings, the BRUKL output reports contain an 'HVAC Systems Performance' table comparing the cooling demand of the actual and notional buildings for different building elements. The aim should be to reduce the actual cooling demand below that of the notional for each of the non-domestic spaces in the development where an active cooling load exists. This should be demonstrated by completing the relevant table in the GLA's carbon emissions spreadsheet, which follows the format provided in Table 6. The area weighted average actual and notional cooling demands for all non-domestic areas should be reported.

8.21. If meeting the notional cooling demand is not possible, the applicant should provide a clear explanation of why it is not possible and outline the implications for building design.

Table 6: *Reporting template for cooling demand*

	Area weighted average non-domestic cooling demand (MJ/m^2)	Total area weighted non-domestic cooling demand (MJ/year)
Actual		
Notional		

8.22. If an active cooling strategy is required, it should be set out in the energy assessment and include details of the active cooling plant being proposed, including efficiencies, and the ability to take advantage of free cooling and/or renewable cooling sources. Where appropriate, the cooling strategy should investigate the opportunities to improve cooling efficiencies to reduce carbon emissions through the use of locally available energy sources such as ground cooling, river/dock water cooling, etc. and efficient technologies such as heat pumps that can be used to provide cooling.

9. Heating infrastructure (Be Clean)

9.1. Once demand for energy has been minimised, all planning applications must demonstrate how their energy systems will exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly to reduce CO_2 emissions, by following the heating hierarchy in London Plan Policy SI 3.

9.2. As well as carbon dioxide emissions, all combustion processes can emit oxides of Nitrogen (NOx) and, solid or liquid fuelled appliances (such as those using biomass or biodiesel) can also emit Particulate Matter. These pollutants contribute to London's poor air quality and can have negative impacts on the health of local residents and occupiers of the development. It is important that these impacts are taken into account in determining the heating strategy of a development. See section on Air Quality at the end of this chapter for further information on the interaction between energy assessments and air quality assessments, including a template for reporting air quality impacts in the energy assessment.

9.3. The growth of London's decentralised energy generation is a core component of decarbonising the city's energy supply. District heat networks are an important part of a sustainable and flexible energy system of which each building is a part, and which enables a more circular approach to energy use by storing, using and re-using energy sources. This supports a more effective and efficient use of energy by reducing primary energy demand and minimising the amount of energy that is ultimately wasted within the system. This will help create an energy system that will enable an optimum pathway to a net zero-carbon London.

9.4. Heat networks offer an efficient and competitive solution for heating buildings in urban areas with high heat density and provide the added benefit of enabling the use of secondary energy or waste heat sources. This allows useful, lower quality energy to be used and re-used within the system to meet lower quality energy demands, such as space heating and hot water, saving high quality energy sources and capacity to meet high quality energy demand. The inherent thermal storage capacity of heat networks helps to manage demand, supports balancing and the flexibility of the electricity network and the integration of increasing volumes of renewable energy into the grid mix. By providing a system-level alternative to building-level solutions, heat networks help manage demand through their inherent storage provision whilst protecting existing capacity in the local electricity network to accommodate additional development and the integration of increasing volumes of renewable energy into the grid mix.

9.5. Heat networks also provide long-term flexibility to achieve decarbonisation. Existing carbon intensive heat sources and production technologies can be substituted at a later time with new, lower carbon and innovative technologies to support the decarbonisation of the network. This in turn is a simpler process for decarbonising heat supply to multiple consumers in one area, removing the need to retrofit individual buildings.

9.6. Other benefits of heat networks include:

- The larger energy centres forming part of heat networks allow for more effective abatement and dispersal of emissions compared to having many small individual systems in an area. These networks then provide the opportunity for buildings close to the network to replace their existing individual gas boilers with a heat interface unit (HIU) and a connection to the heat network.
- The size of district heat networks allows them to realise significant economies of scale, which means that they can minimise operational costs and keep heat costs fair and affordable to help alleviate fuel poverty for residents.
- Fuel diversity and multiple heat sources reduces exposure to fluctuations in commodity prices, and the heat network provides wider energy system benefits, such as balancing and flexibility, to the national grid as it helps to manage the network.
- The reduction of a network's peak demand, through the increased diversity of its heat load and the use of its thermal storage capacity, leads to less carbon intensive sources being used to generate energy.
- There are reduced maintenance costs involved in maintaining a single system compared to many individual systems.

The heating hierarchy

9.7. To comply with London Plan Policy SI 3, developments in Heat Network Priority Areas (HNPAs) (i.e. areas in London where the heat density is sufficient for heat networks to provide a competitive solution for supplying heat to buildings and consumers) should have a communal[23] low-temperature heating system and should select a heat source in accordance with the following heating hierarchy:

a) connect to local existing or planned heat networks

b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)

c) use low-emission combined heat and power (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the

[23] A communal system is one that has a single point of connection served by a single energy centre for the entire site which connects all buildings. Communal systems future proof the development for easy connection to an area wide heat network in the future.

development's electricity demand and provide demand response to the local electricity network)

d) use ultra-low NOx gas boilers

(CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements in Part B of London Plan Policy SI 1 Improving air quality)

9.8. The GLA has set emission limits for boilers, gas engines, turbines and solid and liquid biomass which need to be met in all developments. These emission limits are summarised in Appendix 2. However, meeting these emission limits will not always be sufficient to prevent unacceptable levels of local impact and it is strongly recommended that the development of the energy strategy is co-ordinated with the air quality or environmental impact assessment.

9.9. The design and location of energy centres for communal or district heating networks has a key role to play in reducing air quality impacts; simple measures such as placing the flue on the tallest element of the development can greatly aid dispersion and reduce impacts. Where connection to an existing district heating system is proposed any additional impact on air quality from an increase in capacity or usage should be considered.

9.10. Developments should provide a communal heat network and allow a single point of connection, which will help to facilitate later connection of a development to an area-wide district heating network as it is less costly than retrofitting the site for connection at a later date. For developments with a single building, a building-level heat network will be required and a similar single point of connection.

9.11. For developments outside HNPAs, a communal system is recommended. Individual heating systems would be appropriate for low-density individual housing, where no district heating networks are planned or feasible, or where evidence is provided that a communal system is uneconomic. Ambient loop systems with heat pumps in individual units are regarded as individual heating systems and therefore would not be appropriate for developments in HNPAs.

9.12. Direct electric heating will not be accepted in the majority of cases as it will not provide any on-site carbon savings in line with the energy hierarchy and it is likely to result in higher energy bills. Direct electric systems are also not compatible with connection to district heating networks.

a. Connect to local existing or planned heat network

9.13. Developments proposing to connect to a district heating network may continue to use SAP 2012 emission factors, provided the network operator has submitted its decarbonisation strategy, or its plans to produce one, to the GLA. See section 5 for further information.

Existing networks

9.14. Where a heat network exists in the vicinity of the proposed development, the applicant must prioritise connection and provide evidence of active two-way correspondence with the network operator. This must include confirmation from the network operator of whether the network has the capacity to serve the new development or if they are willing to expand the capacity, together with supporting estimates of installation cost and proposed timescales for connection.

9.15. Examples of existing district heating networks in London include King's Cross, the Olympic Park and Stratford City, Citigen, the Pimlico District Heating Undertaking (PDHU), Barkantine Heat and Power, Whitehall District Heating network, SELCHP, Bunhill heat and power network and the University College London and Bloomsbury networks. This list is not exhaustive, and it may be that there are other developments in the vicinity that have heat networks with spare capacity that it may be viable to connect to.

9.16. Applicants should investigate the potential for connecting the development to an existing heat network system by using the London Heat Map[24] and by contacting the local borough, local heat network operators and nearby developments.

9.17. The latest version of the London Heat Map includes the HNPAs[25] as well as further detail associated with heat sources including secondary heat sources. Data relating to new and expanded networks within the London Heat Map will be regularly updated. In order to keep the Heat Map up to date boroughs and developers are required to contact the GLA post-construction (HeatMap@london.gov.uk) to confirm developments that have connected to a specific heat network or provide updates on heat networks.

9.18. The carbon factor associated with the heat supplied by a network should be obtained from the network operator and be provided in the energy assessment. This should be accompanied by the assumptions used to derive the carbon factor including estimated heat losses. For each heat source, the proportion of heat provided by the source, the generation plant efficiencies and the type of fuel used should all be provided.

[24] www.londonheatmap.org.uk
[25] he Heat Network Priority Areas can be found on the London Heat Map website and identify where in London the heat density is sufficient for heat networks to provide a competitive solution for supplying heat to buildings and consumers.

Planned networks

9.19. If there isn’t an existing network, the applicant must investigate whether a network is being planned for the area. Reference must be made to the relevant borough’s heat mapping report as well as energy master plans[26] or similar studies (e.g. The Mayor's Decentralised Energy Enabling Project (DEEP) studies) carried out involving the borough. Enquiries should also be made to appropriate contacts within the relevant borough and evidence of correspondence should be included in the energy assessment. Examples of planned networks include Vauxhall Nine Elms Battersea, Barking Town Centre District Energy Scheme, Sutton District Energy Network and Euston Road network.

9.20. Where connection is proposed to a planned network the applicant should provide the information in paragraphs 9.14 and 9.18. If no information on the network performance is available applicants should make reasonable assumptions on what the anticipated end use will be.

9.21. Where a network is planned, or in an HNPA, developments must demonstrate that they are designed to connect to the network, in line with the London Heat Network Manual and the proposed network’s design specification.

9.22. Where a development is within an area that could be supplied by a district heating network but the applicant is contending that providing a communal heat network to allow future connection will result in uneconomic costs to end users, the applicant must provide a whole life cycle cost (LCC) analysis comparing the communal and individual systems. See Appendix 5 for further details of how this must be approached. Although LCC results will vary on a case by case basis, modelling usually shows that LCC of well-designed heat networks and individual boilers are broadly similar for high-density developments. Where the LCC of the communal heat network is broadly similar to that of individual gas boilers the network will not be considered uneconomic. Where it can be demonstrated and evidenced that the LCC of the communal heat network is significantly higher than that of individual gas boilers and it can be shown to make the scheme unviable, the communal heat network may be deemed uneconomic.

Supplying heat beyond the site boundary

9.23. Applicants should investigate opportunities for expanding their heat network to supply heat to local developments and buildings outside the boundaries of their site, particularly if this has the potential to facilitate an area-wide heat network. Applicants could look in particular for opportunities to connect to existing local buildings and developments to help reduce their carbon dioxide emissions and this

[26] Available to download at: https://www.london.gov.uk/what-we-do/environment/energy/london-heat-map/resource-library

could help the development if it can't meet its carbon reduction targets on-site to meet them off-site.

9.24. Very large mixed-use developments can often be the catalyst for establishing an area-wide heat network to serve a much larger area. These opportunities for expanding the network into the adjacent area to supply heat should be fully explored. Sufficient allowance should be made in sizing the energy centre and communal heat network infrastructure to allow for expansion of the network to serve a wider area in the future. These plans should be developed early in conjunction with the local borough and the network operator that will be providing the heating/energy solution for site.

Heat network connection scenarios

9.25. The following three scenarios provide examples of how development with different locational and other characteristics can demonstrate a policy compliant response in relation to communal heat networks. Further detail on what information is required where a communal heat network is applicable is provided in paragraphs 9.45 - 9.499.45 and information relating to phased developments and designing heat network infrastructure is provided in paragraphs 9.50 - 9.50.

<u>Scenario 1: Development in areas where there are established plans for district heating</u>

9.26. Where a development is to be located in an area where a heat network is being delivered or there are firm plans for a heat network that are proceeding to implementation, the development should incorporate a communal heat network. If there is a time lag between occupation of the development and the network being able to supply heat, then the developer and the proposed heat network operator should work together to agree a shared approach to the funding and installation of a compatible temporary heat source until the area-wide heat network is able to connect the development. The installation of permanent low-carbon heating plant (such as heat pumps or CHP engines) should be avoided in this scenario as it could impact the financial viability of the connection later on. The temporary solution could be a communal gas boiler.

9.27. Although an on-site low-carbon heat technology may not form part of the energy strategy in these circumstances, the net zero-carbon target will still apply to the new development. In this situation, for the purposes of demonstrating compliance with meeting the target, the developer may include the carbon dioxide emission reductions from connection to the network in the assessment. However, at the planning stage a timescale must be agreed by which the connection to the network must be made. This could be set as:

- A stated number of years following occupation of the development

- A particular date when the heat network has arrived at the development and is ready to connect, either before or after occupation
- An agreed trigger point, e.g. occupation of the x^{th} dwelling.

9.28. If connection is not made by the agreed point, the developer should make appropriate arrangements to install an on-site low-carbon generation heat source to achieve the long-term CO_2 reductions originally envisaged from connection to the heat network.

9.29. The principles set out above should be agreed between the developer, the borough and the GLA prior to the granting of planning approval and clearly set out within the section 106 agreement for the development to ensure that the development does connect to the heat network at the time committed to or at an earlier date if appropriate.

Scenario 2: Development in an HNPA but no firm plans for a heat network currently exist

9.30. Developers will be expected to provide a communal heat network allowing for a safeguarded single point of connection to the site and designing for the minimum amount of energy centres in order to future proof the development for easy connection to a wider heat network in the future. A detailed technical feasibility study should be carried out to inform the type of heat source to be installed in the energy centre (e.g. heat pumps, CHP, ultra-low NOx gas boilers). Developers will be expected to propose a low-carbon heat source for the site and maximise the carbon savings being targeted. The scale and mix of uses on site will impact on the feasibility of different technologies. Appendix 3 provides specific information on the feasibility of low-carbon and renewable technologies.

9.31. Developments greater than 800 dwellings are typically at a scale that would interest an Energy Service Company (ESCO) and applicants should consider engaging with ESCOs to discuss the potential of supporting the design, specification, construction and operation of the district heating network. ESCOs may even be interested in funding an element of this if they are able to create an oversized energy centre and use the development as the basis for establishing a larger area-wide heat network.

Exceptions under scenarios 1 and 2

9.32. Where a development contains small commercial/retail units, i.e. total area $<500m^2$, as is often the case on the ground floor of a residential tower block, it is not necessary to connect these to the communal heat network. These units are often categorised as shell and core at the planning stage and, when built out, have very small heating demands which are usually met by stand-alone air source heat pumps. For these unit types connection is encouraged, but not mandated due to the small benefit in terms of carbon reduction in these circumstances. Where connection is not proposed, the applicant should outline how the units will be future proofed for connection i.e. allowing for capped connections and/or space for plate heat exchangers and future pipes.

9.33. Depending on the density of development, it may not always be appropriate to connect individual houses to heat networks. This is due to the higher network heat losses that typically occur when supplying individual houses that generally have a lower heat density compared to apartments. They also have a higher cost of connection.

Scenario 3: Development in areas where an area-wide heat network is not proposed and which is not within an HNPA

9.34. There are geographic areas where, due to the type and/or low density of the buildings, district heating will not be implemented in the future. Examples of such areas include areas of detached/semi-detached housing or industrial estates with unheated buildings. If it can be clearly and unequivocally demonstrated that the development is not within an area that will be supplied by a district heating network in future, for example where only individual existing houses surround the development, it will not be necessary to make provision for future connection. Each case will be considered on its own merits.

9.35. In such areas, an on-site heat network may still be applicable to a given new development, if this is of sufficient size and density to benefit from a decentralised heating solution (e.g. a high-density development located in close proximity to a waste heat source) or medium to large-scale residential-led, mixed-use developments. Alternatively, a communal heat network within each individual building may be more appropriate. This will be considered on a case by case basis.

b. use zero-emission and/or local secondary heat sources (in conjunction with heat pump, if required)

9.36. The second step of the heating hierarchy encourages the exploitation of local energy opportunities to maximise the use of locally available energy sources whilst minimising primary energy demand and carbon emissions. Secondary heat sources should be used before renewable energy sources but can also be used in conjunction with them to minimise the carbon intensity of the heat network.

9.37. Secondary heat includes environmental sources: air, water and ground; and waste sources: such as heat from the sewerage system, sewage treatment plants, the tube network, data centres and chiller systems[27]. The applicant should investigate waste heat sources of heat on or adjacent to the site. This waste heat, especially if it is low-grade heat, can be re-used to meet demand for low quality energy such as space heating and hot water. Many secondary heat sources will be low-grade heat,

[27] For more information about waste heat see: Secondary Heat Study.

i.e. below 30ºC, and depending on the flow temperature of the heat network that it is being put into, it may need elevating using a heat pump either at source, before going into the network, or at the point of use.

9.38. These low-carbon heat sources can be used for both site-wide networks and as multiple heat sources for area-wide networks, supporting development of new low-carbon heat networks and the decarbonisation of existing heat networks that have gas-engine CHP as their primary heat source.

c. use low-emission combined heat and power (CHP) (only where this is to enable the delivery of an area-wide heat network)

9.39. To date, gas-engine CHP has been the primary technology for facilitating the development of district heat networks due to its high efficiency and better carbon performance compared to electrical systems utilising grid electricity. However, the rapid decarbonisation of the electricity grid means that technologies generating on-site electricity (such as gas-engine CHP) will not achieve the carbon savings they have to date. There are also growing air quality concerns associated with combustion-based systems; with the number of smaller sites using gas-engine CHP now of particular concern.

9.40. In general, larger sites are considered more appropriate in terms of operational regime and available heat load to enable an effective operation of CHP systems, providing that any related emissions are properly abated.

9.41. To address air quality concerns and to continue to facilitate heat networks, only low-emission CHP is suitable and only where it is facilitating an area-wide heat network. New gas-engine CHP at any scale is therefore not a suitable heating solution for new development in London. New developments will continue to be expected to connect to existing networks that are already utilising gas-engine CHP or that have had planning approval on this basis, provided the network operator has submitted a decarbonisation strategy for the network to the GLA. Decarbonisation strategies will include CHP being replaced with a lower carbon alternative, such as a large centralised heat pump, as the CHP nears the end of its lifetime. Going forward, new networks should be served by low emission CHP that complies with the ultra-low NOx emission standards outlined in Appendix 2 or heat pumps.

9.42. London's main heat network operators are in the process of providing decarbonisation plans to the GLA which will allow new developments connecting to them to use SAP 2012 emissions factors, see section 5 for further details.

9.43. Heat network operators of both existing and planned heat networks should provide applicants and the GLA with an outline of their plans to decarbonise the heat network, in line with the Mayor's target for London to be net zero-carbon. This should include:

- A commitment to investigate all available options for decarbonising the network and timings for doing so, e.g. waste heat sources in the area, replacement of gas-engine CHP with other technologies such as heat pumps.
- Evidence of existing (or planned) studies that have been undertaken and timescales for implementing the decarbonisation plans, including investigation of funding for further work from DEEP and government's Heat Network Investment Project (HNIP).
- A detailed plan demonstrating that the process is being monitored in order to ensure its implementation as well as a commitment to keep the GLA updated on progress.

d. use ultra-low NOx gas boilers

9.44. A heating strategy led by ultra-low NOx gas boilers should only be considered when it has been clearly demonstrated that all of the above options (a to c) have been fully investigated and ruled out with sufficient evidence provided to the GLA. Ultra-low NOx gas boilers are also acceptable in cases where they represent interim heating solutions until a site is able to connect to an expanding or new heat network (see also paragraph 9.26). In any case, the proposed boiler would need to meet the air quality criteria as presented in Appendix 2.

Facilitating a heat network connection

9.45. The communal network should allow for a single point of connection to an area-wide network and, prior to this, be supplied from a single energy centre where all energy generating equipment is located. A single energy centre will facilitate the simplest connection (whether immediately, or at a later date) to an area wide district heating network as well as reduce maintenance and operating costs. Therefore, the energy assessment must demonstrate that enough space has been allocated for a sufficiently large energy centre that will allow for its connection to an area-wide heat network. This must be clearly shown on the plan drawings of the development and the floor area in m^2 should be confirmed in writing. A floor plan showing the layout of the plant in the energy centre should also be provided to demonstrate sufficient space has been allowed for the specified equipment and, where applicable, additional equipment to be installed in future.

9.46. Applicants are required to calculate the design heat loss of their proposed system and include them within the energy calculations. These should be based on the pipe length of the total network (both buried and block pipework), design temperatures (including any design summer time temperature reduction) and the level of insulation proposed. Full details should be provided in the energy assessment. A calculation for the resulting system distribution loss factor has been included in the GLA carbon emission spreadsheet; this should be provided as part of the submission and used for the 'be clean'/'be green' stages of the hierarchy.

9.47. It is important that options for reducing the distribution losses are incorporated at planning stage as they will be largely dependent on the building design, for instance optimising circulation spaces to reduce the lateral pipe length. Therefore, the heat loss calculation must be based on the length of distribution pipes rather than a percentage estimate.

9.48. In order to further reduce distribution losses, the use of variable flow control systems to lower flow rates and lower return temperatures at part-load must be investigated and included within the heat loss calculation. At the design stage, it is recommended that careful attention is paid to ensure systems operate with low return temperatures, in line with the CIBSE Heat Networks: Code of Practice for the UK[28].

9.49. Heat network solutions usually benefit from the inclusion of thermal storage. This provides useful balancing for low-carbon technologies, the opportunity to use surplus and low-cost, low-carbon electricity at times of low demand and also helps in the case of heat from renewable and secondary heat sources that may be intermittent.

Phased developments

9.50. Networks that will be implemented in phases should seek to create one energy centre large enough for the entire site. A simple schematic of the communal heat network showing all apartments and non-domestic buildings/uses connected into it, as well as the location of the energy centre(s), must be provided as part of the energy assessment. Where the applicant can provide evidence that a single energy centre is not feasible for the site they must still seek to minimise the number of energy centres and explain how the network will evolve across the development's phasing programme, including indicative timescales and its future connection to an area-wide network. Schematics should be provided showing how the network will evolve and ultimately where and how it will connect to the area-wide network.

9.51. Applicants should explain how their heat network will decarbonise overtime to achieve net zero carbon and the timeline for achieving this.

Designing heat network infrastructure

9.52. New and existing networks should incorporate good practice design and specification standards. Poorly designed heat network infrastructure within a

[28] http://www.cibse.org/knowledge/cibse-other-publications/cp1-heat-networks-code-of-practice-for-the-uk

building, e.g. a residential tower block, can contribute towards internal overheating problems, especially in communal areas, and high service charges. To avoid this, developers should work with their chosen heat network operator from pre-design and commit to designing and delivering communal heating systems in compliance with the London Heat Network Manual II, the CIBSE/ADE Heat Networks: Code of Practice for the UK and in partnership with energy services companies that are - or are working towards being - registered participants of the Heat Trust scheme[29]. This will support the development of good quality networks whilst helping network operators prepare for regulation and ensuring that customers are offered a reliable and cost-competitive service.

9.53. Boroughs are advised that all applications proposing communal heat networks are conditioned to register and comply with the Heat Trust for added customer protection. It will be expected that boroughs apply relevant conditions on developments ensuring the heat networks' optimal performance.

9.54. Further detail on these standards and schemes is provided below.

London Heat Network Manual

9.55. The London Heat Network Manual[30] provides guidance for applicants and designers and should be consulted on matters associated with:

- a comprehensive, but not exhaustive, list of existing and proposed district heating opportunities in London;
- information on designing developments to allow connection to District Heat Networks (DHNs); and
- key design considerations for the generation, transmission and consumption equipment for DHNs such as:
  - various heat sources including hybrid systems,
  - primary and secondary heat distribution network design and key characteristics (e.g. flow and return temperatures) to optimise operation and reduce losses and overheating risk,
  - the approach to be taken when specifying pipework insulation,
  - thermal storage provision,
  - smart controls and their importance on optimising the overall network performance,
  - appropriate heat metering arrangements (including Automated Meter Readers (AMR) and emerging smart meter technologies) including the components of the meters and their location,
  - ambient networks operational considerations.

[29] http://www.heattrust.org/index.php
[30] https://www.london.gov.uk/what-we-do/environment/energy/london-heat-map/resource-library

The Heat Trust

9.56. The Heat Trust was established in November 2015 from collaboration between industry, consumers and government with the aim to establish a common standard in the quality and level of protection given by heat supply contracts. The Trust is also intended to offer heat network customers an independent process for settling disputes. The Heat Trust mark is a sign that the heat supplier has agreed to abide by the standards set out in the scheme and the GLA expects network operators to sign up to the scheme.

CIBSE Heat Networks Code of Practice

9.57. The Heat Networks Code of Practice has been developed to improve the quality of feasibility studies, design, construction, commissioning and operation of heat networks in the UK by setting minimum requirements and identifying best practice options. Network losses should be investigated at the earliest opportunity as they have significant implications on the efficiency of the network (both cost and CO_2) and the thermal comfort of occupants.

9.58. The Code of Practice includes recommendations on designing to minimise pipe lengths (particularly lateral pipework in corridors of apartment blocks), using low temperature systems and adopting pipe configurations selected to minimise heat loss e.g. twin pipes. The level of pipework insulation is also identified in the Code of Practice as a key issue and designers are expected to target levels of insulation significantly better than building regulations and British Standard requirements in order to stay within the heat loss levels identified in the Code of Practice.

Air quality impacts

9.59. The energy assessment alone is not sufficient to describe or assess impacts on local air quality and therefore for all major developments a separate air quality assessment is required under London Plan Policy SI 1. A robust air quality assessment relies on good quality, timely information about the energy strategy. If there are differences of data or information between the energy and air quality assessment this can lead to delays or additional reporting during the planning application process. Similarly, an energy strategy that has significant impacts on local air quality may lead to a planning application being refused.

9.60. It is therefore important that energy and air quality assessments are aligned at an early design stage and during the development process and that the energy assessment shows how the energy data has been carried across into the air quality assessment.

9.61. It is necessary to understand any constraints imposed by local air quality conditions before deciding on an energy strategy, or to provide additional information on the location, design and proposed technology for the energy centre to further assist the air quality assessment.

9.62. In order to assist the assessment of air quality impacts in line with London Plan policy, **Error! Reference source not found.** should be completed and provided in an appendix to the energy assessment. To ensure that the air quality assessment is as robust as possible it is important that the figures provided account for the total input, for instance the proportion of gas consumed in generating electricity from any proposed CHP plant, and must be included in the table.

Table 7: *Reporting template for air quality impacts*[31]

Energy source	Total fuel consumption (residential) (MWh/year)	Total fuel consumption (non- residential) (MWh/year)
Grid electricity		
Gas boilers (communal/individual)		
Gas CHP		
Connection to existing DH network		
Other gas use (e.g. cookers)		

[31] The data required to fill in this table can be derived from the fuel consumption information provided under the GLA Carbon Emissions spreadsheet.

10. Renewable energy (Be Green)

10.1. Energy assessments should explain how the opportunities for producing, storing and using renewable energy on-site will be maximised, in line with Policy SI 2 of the London Plan. Within the main body of the energy assessment, detailed site specific analysis should only be provided for those renewable energy technologies considered feasible. Site-specific analysis for those technologies not considered feasible should be included in an appendix.

10.2. The GLA expects all major development proposals to maximise on-site renewable energy generation. This is regardless of whether the 35% on-site target has already been reached through earlier stages of the energy hierarchy. In particular, solar PV should be maximised on roof spaces.

10.3. Information required on renewable energy generation:

- An assessment of what is achievable and compatible with the measures already implemented in steps one and two of the energy hierarchy should be provided.
- Applicants should provide calculations to demonstrate that their chosen renewable system or systems will reduce CO_2 emissions. The percentage CO2 reduction from renewable energy should be expressed relative to the Part L 2013 regulated energy baseline (see Table 2 and Table 3).
- High efficiency systems (e.g. state of the art PV panel models) and innovative technologies should be considered in the interest of maximising on-site CO_2 reductions.
- If a number of renewable energy technologies are proposed, it will be important to demonstrate how they will work in tandem and, where applicable, how they will be integrated into a heat network (for heat generating technologies) and, again where applicable, also how they will integrate with a cooling system/strategy.

10.4. Appendix 3 provides further guidance in relation to detailed requirements for particular types of renewable energy systems. Where a particular type of renewable energy system is proposed, the relevant section should be consulted and required information provided as part of the energy assessment.

10.5. The sections below outline the information requirements for the most commonly proposed renewable technologies:

Heat pumps

10.6. Heat pumps should always be categorised under this third and final element of the energy hierarchy (not the first element, "be lean") unless they are serving district heating networks. In that case, they should be categorised under 'be clean'.

10.7. Where heat pumps are proposed, a high specification of energy efficiency will be expected to ensure the system operates efficiently and to reduce peak electricity demand. This applies to any type of heat pump proposals including air source heat pumps (ASHPs), ground source heat pumps (GSHPs), water source heat pumps (WSHPs) or hybrid and ambient loop types of systems.

10.8. There are various factors that influence the efficiency of a heat pump system and these include the building use (residential or non-domestic), the source temperature, the output (flow) temperature, the distribution losses and the pumping energy. Where standard manufacturer details are used, without considering the proposed system requirements, the reported carbon emission saving is likely to be optimistic and incorrect. As such, a set of specification requirements, outline below, should be provided for the entire heating system rather than the technology itself, allowing for the consideration of other factors that could compromise optimal operation.

10.9. The following information will be required as part of the applicant's submission:

- Details of the Seasonal Coefficient of Performance (SCOP), the Seasonal Performance Factor (SFP) and Seasonal Energy Efficiency ratio (SEER), which should be used in the energy modelling. This should be based on a dynamic calculation of the system boundaries over the course of a year i.e. incorporating variations in source temperatures and the design sink temperatures (for space heat and hot water). Details of the assumptions should be included in the energy assessment, including manufacturer datasheets showing performance under test conditions for the specific source and sink temperatures of the proposed development and assumptions for hours spent under changing source temperatures.

- Clarification as to how the heat pump will operate alongside any other heating/cooling technologies being specified for the development (i.e. how will the heat pump system operate alongside communal heating systems, and/or combined heat and power plant, solar thermal, etc. if they are also being proposed by the applicant)

- Whether any additional technology is required for top up, for instance during peak loads. This should be incorporated into the energy modelling assumptions and explanation of how this has been done should be provided.

- The approach to generating domestic hot water. To optimise the system's operation it will be expected that thermal store will be integrated in the majority of applications; the operation of the system should be provided.

- A calculation of the CO_2 savings that are expected to be realised through the use of this technology.

- An estimate of the expected heating costs to occupants, demonstrating that the costs have been minimised through energy efficient design.

- An estimate of the heating and/or cooling energy the heat pump would provide to the development and the electricity the heat pump would require for this purpose. Particularly for GSHP systems this estimation should be supported by the following information:

  - For closed loop systems, an indication of the land area available that would be required to install the required number of boreholes. Where possible, the ground conditions of the specific site should be taken into account for the calculations.

  - For open loop systems (including aquifer thermal storage systems), the flow rate of water that is available on-site. It should be used to estimate the amount of heating/cooling the system could provide.

- Applicants will need to provide a diagram of the proposed location of the heat pumps and the associated condenser units. Where condenser units are installed internally there should be adequate access to air flow. For developments in HNPAs, the diagram should include the pipework which will be installed for future connection to a heat network (see also paragraph 9.10).

- Specifically for ASHPs, evidence that the heat pump complies with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) product criteria for the relevant ASHP technology as well as evidence that the heat pump complies with other relevant issues as outlined in the Microgeneration Certification Scheme Heat Pump Product Certification Requirements document at: http://www.microgenerationcertification.org

- Specifically for GSHPs, confirmation that the site geology is suitable for the installation of the GSHP and also evidence of the likelihood of a permit being granted by the Environment Agency, where required.

- Confirmation that end-users will be supplied with regular information to control and operate the system e.g. at point of occupancy and maintenance visits.

- A commitment to monitor the performance of the heat pump system post-construction to ensure it is achieving the expected performance approved during planning, in line with the be seen policy.

Photovoltaic (PV) panels

10.10. The following information is required where photovoltaic panels are proposed:

- Drawings showing the amount of roof that is available within the development and that could be used to install photovoltaic modules with suitable orientation and lack of shading. The shading analysis should include an assessment of the height of existing buildings and any permissions granted for buildings near the application site.
- An estimate of the total PV system output (kW_p)
- Quantification of the amount of roof area that could be used to install photovoltaic modules.
- An estimate of the electricity that the photovoltaic modules will generate including the assumptions for the calculations.
- A calculation of the CO_2 savings that may be realised through the use of this technology.
- A confirmation that the performance and output of the system will be monitored, in line with the be seen policy and relevant guidance document.

11. Flexibility and peak energy demand

11.1. This section explains how applicants should respond to London Plan Policy SI 2 and SI 3 in relation to 'minimising both annual and peak energy demand' and related paragraphs SI 2 9.2.2 ("an important aspect of managing demand will be to reduce peak energy loadings") and SI 2 11A ("opportunities to maximise renewable electricity generation and incorporate demand-side response measures").

11.2. Smart buildings have been identified and acknowledged as key enablers of future energy systems for which there will be a larger share of renewables, distributed power and heat generation, and demand-side flexibility to match demand to supply and make best use of existing network connection and local generation capacity.

11.3. The aim is to encourage applicants to investigate the potential for energy flexibility in new developments, include proposals to reduce the amount of capacity required for each site and to reduce peak demand. The assumption is that, if peak electrical demand is reduced across London, then less power infrastructure and less carbon-intensive electricity generating plant will be needed to meet that demand.

11.4. Demand Side Flexibility[32] provides the capability to lower developer and occupier costs in the context of predicted future energy cost rises. It can also enable some buildings to earn income by providing grid and network support services. Reducing peak energy consumption could also allow a developer to negotiate lower connection fees to the electricity grid Distribution Network Operator (DNO). Similarly, buildings that are enabled to modify when they draw energy from networks in real time through the use of Demand Side Management (DSM) and storage systems increasingly have the potential to take advantage of dynamic pricing in the electricity market, providing opportunities to reduce occupants' energy bills.

11.5. The applicant should therefore report the calculations of peak demands for the entire development, demonstrate engagement with DNOs and district heating operators to establish the local capacity (including consideration given to future phases) and set out proposals for flexibility to reduce peak demand across the site.

11.6. This should be summarised in Table 8 and included in the energy assessment. Further detail and guidance on what is required under each action has been included underneath the table.

[32] Demand side flexibility refers to the ability of a system to reduce or increase energy consumption for a period of time in response to an external driver (e.g. energy price or carbon signal change, grid availability).

Table 8: *Summary of site-wide peak demand, capacity and flexibility potential*

	Electrical[33]	Heat[34]	Enabled through…
Estimate peak demand (MW)			Realistic estimates of demand profiles and peak demand
Available capacity (MW)			Early engagement with the DNO or IDNO to establish available capacity
Flexibility potential (MW)			Modelling of flexibility using demand profiles
Revised peak demand (MW)			Revision to peak demand considering available capacity, engagement with third parties and flexibility potential
Percentage flexibility predicted (%)			Calculations from flexibility potential as a proportion of peak demand

Estimate peak demand

11.7. Applicants should report and explain the peak demand calculation and assumptions using a recognised approach. Graphics showing the modelled demand profiles used for the peak demand calculation should also be included in the energy assessment.

11.8. In addition, the following should be investigated and reported in the energy assessment:

- Diversity factors and spare capacity factors (informed by DNO) used to establish the maximum demand figure, along with reasons for using those figures. This would, for example, include allowances made for the increased uptake of electrical demand from electric vehicles and heat pumps in the future, particularly on phased developments.
- Consultation with the licensed operator to examine the peak demands and evidence of correspondence.
- Commitment to undertake detailed design calculations post planning and revisit factors of safety applied to the sizing of equipment.

[33] including heat provided by electricity
[34] from district heating, gas or other sources

Available capacity

11.9. Applicants should engage with the DNO or iDNO and consult available DNO constraint maps[35] to establish available capacity and flexibility potential for the site. The potential for collaboration (heat network or connection opportunities) with neighbouring sites should also be explored.

Flexibility potential and revised peak demand

11.10. Applicants are required to determine the potential to reduce the peak demands through modelling and investigation of the flexibility measures outlined in Table 9, which should be included in the energy assessment. In exploring flexibility potential, applicants should engage with third parties to investigate potential partnerships and investment opportunities to increase flexibility, reduce peak demand and facilitate load shifting.

Table 9: *Summary of interventions for achieving flexibility*

Flexibility achieved through:	Yes/No	Details
Electrical energy storage (kWh) capacity		
Heat energy storage (kWh) capacity		
Renewable energy generation (load matching)		
Gateway to enable automated demand response		
Smart systems integration (e.g. smart charge points for EV, gateway etc.)		
Other initiative		

Energy storage[36]

11.11. Applicants should be able to demonstrate that the following has been considered in the development proposals:

- thermal and electrical energy storage, if appropriate, as part of a flexibility solution to reduce peak demands
- energy storage interfacing with the demand and the renewables generation on site
- opportunities to obtain funding for energy storage with third parties

[35] e.g. for electric vehicles see: https://innovation.ukpowernetworks.co.uk/2019/06/10/ev-network-impact/
[36] Energy storage refers to the ability of a physical system to consume, retain and release energy as required. This allows system flexibility in response to specific energy demands.

11.12. Applicants will be expected to consider:

Renewables generation and integration

- optimising opportunities to incorporate renewable energy technologies and integrating renewable technology with other components of the system including storage, EV charging, control systems, energy management systems etc.

Smart systems gateway and integration

- designing for energy systems that are smart through the integration between different systems, including landlord (owner) and tenant (occupants), electric vehicle charging points, security systems, white goods (if installed), etc.
- inclusion of a configurable gateway that allows automated Demand Side Response (DSR) to dynamic pricing signals and integration with micro-grids and energy networks
- providing secure, remote access to data which occupants and building owners can access
- providing secure, remote communication of consumption data between the meter and the supplier
- including metering points that will be compliant with relevant pattern approval and Measuring Instruments Directive (MID) standards for fiscal billing
- providing an open protocol that allows devices to be connected without having to use proprietary systems

Glossary

Building Emissions Rate (BER) or Dwelling Emission Rate (DER) - the actual building/dwelling CO_2 emission rate. It is expressed in terms of the mass of CO_2 emitted per year per square metre of the total useful floor area of the building (kg/m^2/year). In order to comply with Part L of the Building Regulations, the BER/DER must be less than the TER (see below).

Combined Heat and Power (CHP) - defined as the simultaneous generation of heat and power in a single process.

Communal heating - a general term for a shared heating system in a single building where heat is supplied to multiple dwellings and/or non-domestic uses using pipes containing hot water.

Energy assessment/strategy – an energy assessment/strategy is a document which explains how the London Plan targets for CO_2 reduction will be met for a particular development within the context of the energy hierarchy.

Individual gas boiler – a gas boiler is installed in a dwelling or a non-domestic building to provide the property with heat. In this case natural gas (rather than hot water) is piped to the property.

kilowatt (kW) – One thousand watts. A watt is a measure of power.

Megawatt (MW) – One million watts. A watt is a measure of power.

Other low carbon heat technology – in the context of this document, this is intended to be any waste heat source that could be used to serve a heat network, potentially with the use of heat pumps to increase the output. For example, waste heat recovered from the waste incineration process, or from transformers.

Part L of the Building Regulations – Approved documents L1A and L2A of the Building Regulations relate to the conservation of fuel and power in new dwellings and new buildings other than dwellings respectively.

Regulated CO_2 emissions – The CO_2 emissions arising from energy used by fixed building services, as defined in Approved Document Part L of the Building Regulations. These include fixed systems for lighting, heating, hot water, air conditioning and mechanical ventilation.

Simplified Building Energy Model (SBEM) - a computer program that provides an analysis of a building's energy consumption. The purpose of the software is to produce consistent and reliable evaluations of energy use in non-domestic buildings for Building Regulations compliance.

Communal heat network – a set of flow and return pipes circulating hot water to the apartment blocks (and apartments contained therein) and non-domestic buildings on a development.

Standard Assessment Procedure (SAP) - a methodology for assessing and comparing the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of dwelling energy performances that are needed to underpin Building Regulations and other policy initiatives.

Target CO_2 Emission Rate (TER) - the minimum energy performance requirement for a new dwelling/building. It is expressed in terms of the mass of CO_2 emitted per year per square metre of the total useful floor area of the building (kg/m^2/year).

Zero carbon homes - homes forming part of major development applications (i.e. those with 10 or more units) where the residential element of the application achieves at least a 35% reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site[6]. The remaining regulated carbon dioxide emissions, to 100%, are to be offset through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

References

London Plan
https://www.london.gov.uk/what-we-do/planning/london-plan

Sustainable Design and Construction SPG
https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/Sustainable%20Design%20%26%20Construction%20SPG.pdf

London Heat Map
http://www.londonheatmap.org.uk/

Energy Monitoring Reports
https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/energy-planning-monitoring

Carbon Offset Funds guidance
https://www.london.gov.uk/sites/default/files/carbon_offsett_funds_guidance_2018.pdf

Appendix 1

Good Homes Alliance 'Early Stage Overheating Risk Tool'

The Good Homes Alliance (GHA) has developed an overheating tool[37] and accompanying guidance[38] with the aim of identifying and mitigating overheating risks in new homes.

The tool is intended for use at the early design stages of new residential development in order to identify key factors contributing to overheating risk, and possible mitigation measures. It consists of a scoresheet containing 14 questions that help classify the level of overheating risk from low to high.

Accompanying guidance notes have been developed for each question to provide additional information with examples of scoring and advice on interpreting the scorecard.

Applicants are required to complete the GHA Early Stage Overheating Risk Tool and submit it to the GLA as early as possible during the development of the design.

[37] https://goodhomes.org.uk/wp-content/uploads/2019/07/GHA-Overheating-in-New-Homes-Tool-and-Guidance-Tool-only.pdf
[38] https://goodhomes.org.uk/wp-content/uploads/2019/07/GHA-Overheating-in-New-Homes-Tool-and-Guidance.pdf

Figure 3 – *GHA Early Stage Overheating Risk Tool*

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

Good Homes Alliance

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | **KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING**

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map	South east	4	
	Northern England, Scotland & NI	0	
	Rest of England and Wales	2	
#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	3	
	Grtr London, Manchester, B'ham	2	
	Other cities, towns & dense sub-urban areas	1	

#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	1	

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	**Day** - reasons to keep all windows closed	8	
	Day - barriers some of the time, or for some windows e.g. on quiet side	4	
	Night - reasons to keep all windows closed	8	
	Night - bedroom windows OK to open, but other windows are likely to stay closed	4	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	1	
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	1	

Scheme characteristics and dwelling design

#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	3	
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	3	

#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance		1	
#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans	>2.8m and fan installed	2	
	> 2.8m	1	

Solar heat gains and ventilation

#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65%	12	
	>50%	7	
	>35%	4	
#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation	Single-aspect	3	
	Dual aspect	0	

		Full	Part	
#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per **#6**	>65%	6	3	
	>50%	4	2	
	>35%	2	1	

		= Part F	+50%	+100%	
#14 Do windows & openings support effective ventilation? Larger, effective and secure openings will help dissipate heat - see guidance		*Openings compared to Part F purge rates*			
	Single-aspect	minimum required	3	4	
	Dual aspect		2	3	

TOTAL SCORE [ ] = Sum of contributing factors: [ ] *minus* Sum of mitigating factors: [ ]

High — 12 — Medium — 8 — Low

score >12:
Incorporate design changes to reduce risk factors and increase mitigation factors
AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score between 8 and 12:
Seek design changes to reduce risk factors and/or increase mitigation factors
AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)

score <8:
Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

Appendix 2

NO_x and PM_{10} emissions limits for heating plant

These emission limits are extracted from the GLA "Sustainable design and construction" SPG 2014 and presented here for information. The SPG may be updated from time to time and you should always check the GLA website for up to date guidance.

As well as meeting the carbon reduction targets, it is important that emissions of Oxides of Nitrogen (NO_x) and Particulate Matter (PM_{10}) from heating and energy plant are minimised to reduce impacts on London's air quality. A tiered approach has been developed for applicable emission standards based upon differentiation according to the baseline air quality in the area of development.

Emissions limits are summarised in the table below, full details of these limits and other technical standards needed to ensure the proper dispersion of pollutants from plant used in heating and power systems can be found in the GLA Supplementary Planning Guidance "Sustainable Design and Construction".

Table 10: *Air quality emissions standards*

Type of appliance	Emissions limit: NOx	Emissions Limit: PM10	Where it applies
Boiler [A]	40 mg/kWh	-	All developments
Spark ignition engine (natural gas/biogas) [B]	250 mg/Nm^3	-	Annual Mean NO_2 > 5% below national objective
Spark ignition engine (natural gas/biogas) [B]	95 mg/Nm^3	-	Annual Mean NO_2 between 5% below or above national objective
Compression ignition engine (diesel/bio-diesel) [B]	400 mg/Nm^3	-	All developments
Gas turbine [C]	50 mg/Nm^3	-	Annual Mean NO_2 > 5% below national objective
Gas turbine [C]	20 mg/Nm^3	-	Annual Mean NO_2 between 5% below or above national objective

Type of appliance	Emissions limit: NOx	Emissions Limit: PM10	Where it applies
Solid biomass boiler D	275 mg/Nm^3	25 mg/Nm^3	Annual Mean NO_2 and PM_{10} > 5% below national objective
Solid biomass boiler < 1MW$_{th}$ input D	180 mg/Nm^3	5 mg/Nm^3	Annual Mean NO_2 and PM_{10} between 5% below or above national objective
Solid biomass boiler ≥ 1MW$_{th}$ input D	125 mg/Nm^3	5 mg/Nm^3	Annual Mean NO_2 and PM_{10} between 5% below or above national objective

A Combustion appliances operating less than 500 hours per annum are exempt from these standards

B Emission standard quoted at reference conditions 273K, 101.3kPa, 5% O2, dry gas

C Emission standard quoted at reference conditions 273K, 101.3kPa, 15% O2, dry gas

D Emission standard quoted at reference conditions 273K, 101.3kPa, 6% O2, dry gas

Where an installation is also subject to an Environmental Permit with different emission limits, the more stringent standard should apply.

It should be noted that while it is necessary to meet these limits, these are minimum standards that may not be sufficient to prevent unacceptable local impacts on local air quality. The impact of communal and district heating systems with one or more energy centres should be considered as part of the Air Quality Impact Assessment or Environmental Impact Assessment for the development.

Appendix 3

Guidance on different types of technologies

Details required in relation to solar thermal

The following information is required where solar thermal is proposed:

- Clarification on how the solar thermal collectors will operate alongside the heating system being proposed by the applicant
- Drawings showing the amount of roof that is available within the development and that could be used to install solar thermal collectors with suitable orientation and lack of shading
- Quantification of the amount of roof area that could be used to install solar collectors
- An estimate of the heating requirements that the solar thermal collectors may provide including the assumptions for the calculations
- A calculation of the CO_2 savings that may be realised through the use of this technology.
- A confirmation that the performance and output of the system will be monitored, in line with the be seen policy and relevant guidance document.

Guidance and details required in relation to low emission Combined Heat and Power (CHP)

Low emission CHP is one of various technology options that could be selected to produce the heat to serve district heat networks. Any applications based on low emission CHP will be expected to provide sufficient information to justify its use and ensure that the carbon and air quality impact is minimised, for example through the selection of a lower emission unit and use of abatement technology.

The following types of development will not be considered appropriate for low emission CHP:

- Small-medium residential developments
- Non-domestic developments with a simultaneous demand for heat and power that do not have a year round base load for optimum operation of CHP

Information required where CHP is applicable

Where CHP is applicable, detailed information should be provided in the energy assessment including the size of the engine proposed (kWe/kWth), the provision of any thermal store and suitable monthly demand profiles for heating, cooling and electrical loads, cost benefit analysis, carbon reduction benefits, etc. The plant efficiencies used when modelling carbon savings should be the gross values rather than the net values often provided by manufacturers. The size of the CHP must be optimised based on the thermal load profile before renewable energy systems are considered for the site. CO_2

savings from the CHP must be expressed as a percentage reduction on the regulated emissions of the Part L 2013 compliant development.

Cross referencing the Air Quality Assessment, the energy assessment should confirm that the NOx emission standards set out in the SPG on Sustainable Design and Construction will be met. It is expected that exhaust treatment systems will be needed to meet the emission standards. This is likely to have significant spatial implications so the energy assessment should include details about the exhaust treatment methods specified and how these will be accommodated on site. It is expected that CHP plant will be required to demonstrate that the installed system meets these limits by emissions testing prior to occupation. The energy assessment should include a commitment that the CHP operator will be required to monitor and provide evidence on a yearly basis, in the form of an annual maintenance report, to demonstrate continued compliance with the emission limits. (It is recommended that boroughs condition this).

For larger installations (above 1 MW thermal input) a permit from the Environment Agency may be required to install and operate the CHP. The details of the required permit will depend on whether the CHP system(s) are classified as “medium combustion plant” or “specified generators” but will usually include meeting emissions limits and ongoing monitoring and reporting of emissions to the regulator. The 1 MW threshold is calculated differently for Medium Combustion Pant and Specified Generators, with the latter based on the aggregated capacity of plant on the same site. Full details of the permitting regime, and the online application forms, are available on the Environment Agency website.

Regardless of whether a permit is required developments will need to show that they are air quality neutral[39]. Normally the assessment against air quality neutral benchmarks will be undertaken as part of the air quality assessment for the development. Early engagement with the client or their air quality consultants is strongly advised to ensure that the right information is shared between teams and that any air quality issues can be addressed before the design of the energy strategy is finalised.

Details of the commercial operation of the CHP, such as information on how any sales of power will be managed should also be provided (this is particularly important where power is being exported to the local distribution network). Where appropriate, details of communication with ESCOs must also be supplied.

Details required in relation to biomass application and biomass emissions standards

39 https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/Sustainable%20Design%20%26%20Construction%20SPG.pdf. Please note that the guidance will be revised.

Like CHP biomass can have significant impacts on local air quality, therefore all of the air quality considerations set out above (especially around liaison and information sharing with air quality specialists) apply to proposals that include biomass.

Please refer to the London Environment Strategy, London Plan Policy SI 1 and relevant sections of the Sustainable Design and Construction supplementary planning guidance for more detail on specific air quality requirements: where the use of biomass is proposed, the biomass boiler must meet the Mayor's biomass standards as set out in the SPG on Sustainable Design and Construction.

In addition to NOx emissions, biomass can also emit particulate matter both from the combustion and from delivery and storage of the fuel. Controlling these emissions may require additional space for particulate abatement equipment.

Details required in relation to liquid biofuel applications

Where the use of biofuel is considered appropriate the following information will also be required:

- Details of the manufacturer's warranty for the use of the proposed liquid bio-fuel in the CHP unit chosen.
- Confirmation of the blend and standard of biofuel to be used (typically B100 BS EN 14214).
- Details of potential supplier(s) of the bio-fuel to be used and written confirmation that they can supply the required quantities.
- Information relating to the maintenance regime of the CHP as a consequence of biofuel use.
- Review air quality implications of bio-fuel with borough air quality officers.
- Information relating to the sustainability and carbon intensity of the bio-fuel in line with the Government's Renewable Transport Fuel Obligation (RTFO) carbon and sustainability methodology for bio-fuels.
- Details of how the fuel will be stored on site.
- The running costs of a CHP utilising biofuel will typically be higher than a conventional CHP engine using natural gas. Confirmation that this increased running cost has been acknowledged and that it will not affect the proposed operation of the CHP is required.

As with solid biofuels, combustion of liquid biofuels can lead to additional NOx and particulate emissions and the same considerations apply to combustion emissions. Although biofuels are unlikely to emit particulates from storage, some fuels may have the potential to emit volatile organic compounds and expert advice should be sought.

Details required in relation to wind energy applications

Where the use of wind energy is considered appropriate the following information will be required:

- Estimation of the wind resource on-site at turbine height. The use of the UK Wind Speed (NOABL) Database on its own is unlikely to be appropriate to estimate the wind resource for the majority of wind energy applications in London. Instead, methodologies that modify the wind resource considering the type of terrain (flat terrain, farm land, suburban, urban etc) and surrounding obstacles should be used.
- Drawings showing the wind turbine location and height in relation to the surrounding structures and including the predominant wind directions
- An estimate of the electricity that the wind turbine/s modules may generate calculated using the estimated wind resource and the wind turbine characteristics i.e. power curve if available or a specific turbine swept area.
- A calculation of the CO_2 savings that may be realised through the use of this technology.
- A confirmation that the performance and output of the system will be monitored, in line with the be seen policy and relevant guidance document should also be provided.

Appendix 4

Notional specification for existing buildings

The following tables outline the key specification values that should be used to determine baseline emissions for existing building planning applications. Where elements or system types are not referenced, the applicant should use the Approved Documents L1B and L2B as well as the Government's Building Services Compliance Guidance to determine a suitable performance value.

It should be noted that these specifications have been developed to determine a consistent baseline across refurbishment planning applications and are not intended to be prescriptive specifications for developments. Applicants may choose to explore alternative approaches, provided the proposed specifications meet GLA requirements.

Table 11: *Non-domestic notional specification for existing buildings*

Element	Unit	Specification[1]
External Wall	W/m²K	0.55
Roof	W/m²K	0.18
Floor	W/m²K	0.0.25
Glazing	W/m²K	1.80
Vision element	g-value	0.40
Air permeability	(m^3/h m^2 @ 50 Pa)	• Less than 10 – only with an accredited air pressure test result • 10 – buildings > 500 m^2 built to 2002 Building Regulations (or later) • 15 – buildings <= 500 m^2 built to 2002 Building Regulations (or later) • 15 – Buildings built to 1995 Building Regulations • 25 – buildings built to Building Regulations pre 1995
Thermal Bridging	W/m²K	Default
HVAC System	Type	System type as per actual building and heating provided by Gas boiler
Heating and Hot Water	%	84% gross efficiency gas boiler

Element	Unit	Specification[1]
Cooling (air-condition)[2]	SEER	• 2.60 – for packaged air conditioners, split/multi-split air conditioners & variable refrigerant flow • 3.90 – Vapour compression cycle chillers, water cooled < 750 kW • 4.70 – Vapour compression cycle chillers, water cooled > 750 kW
Central ventilation SFP	W/l/s	2.20
Terminal Unit SFP	W/l/s	0.50
Heat Recovery	%	70%
Lighting	Lm/Watt	51

1. For instances where the existing condition of the building is of a higher performance, the actual energy performance of the building element should be used rather than the Notional Specification for Existing Buildings.
2. Only where present in actual building and the cooling hierarchy has been correctly followed

Table 12: *Domestic notional specification for existing buildings*

Element	Unit	Specification[3]
External Wall	W/m²K	0.55
Roof	W/m²K	0.18
Floor	W/m²K	0.55
Glazing	W/m²K	1.60
Vision element	g-value	0.63
Air permeability	(m^3/h m^2 @ 50 Pa)	Default - determined by fabric element types
Thermal Bridging	W/m²K	Default
HVAC type	-	Gas boiler, naturally ventilated
Heating and Hot Water	%	89.5%
Cooling (air-condition)	SEER	None
Lighting	%	75% low energy lighting

3. For instances where the existing condition of the building is of a higher performance, the actual energy performance of the building element should be used rather than the Notional Specification for Existing Buildings.

Appendix 5

Required approach to life-cycle costing

This section provides information on how life-cycle costing (LCC) must be approached where the developer claims that adopting communal heating to facilitate a heat network connection will result in uneconomic costs to end users. It provides broad guidance on how the LCC must be approached - individual assumptions will be subject to scrutiny.

The LCC analysis should be conducted over a 30-year period, with the heat network assumed to have a lifespan of at least this duration. The residual value of the heat network and, where applicable, the alternative individual boilers at the end of the analysis period should be taken into account.

The discount rate should reflect the sources of finance that will be used to implement the system, e.g. for social housing funded by government grant a 3.5% discount rate should be assumed in line with HM Treasury Green Book guidance.

The analysis must take into account:

- Initial installed capital cost - for the heat network this would typically be expected to be around £5,500 per apartment. This excludes the costs of internals downstream of the hydraulic interface unit (HIU) which should be assumed to be the same as those for an individual boiler. Cost estimates should be obtained from established district heating installation companies.
- Replacement costs – an individual boiler will typically be replaced twice during the lifetime of a heat network.
- Annual fuel costs – due to bulk purchasing communal boilers will have a lower unit gas cost than individual gas boilers.
- Annual operation and maintenance costs.
- Annual meter reading and billing administration costs – for heat networks this would not be expected to be greater than £80 per dwelling per annum.

In determining the annual fuel costs for the heat network option reasonable assumptions must be made regarding the heat loss and efficiency of the communal boilers. Best practice design should be assumed for the heat network e.g. low temperatures, twin pipes, etc. The case specific heat loss should be estimated for the particular project in question.

Appendix 6

Ensuring waste to energy plants maximise heat and power opportunities

Some developments whose purpose is to process waste will also produce fuel (e.g. bio gas or a solid recovered fuel) and combust the fuel to produce electricity. This will usually be via an engine or, in larger scale installations, a boiler to produce steam for a steam turbine. To achieve energy efficient operation in the future, it is essential that these facilities are designed with a heat off take facility, i.e. a design which allows useful heat produced during the electricity generation process to be recovered. In such circumstances, the primary purpose of the energy assessment is to provide details of the heat off take facility, e.g. plant description, heat output capacity, technical drawings, etc. This will vary depending on whether an engine or steam turbine is to be used:

- Engine - the facility will need to incorporate an exhaust gas heat exchanger and heat exchangers to recover heat from the engine cooling systems.
- Steam turbine - the turbine will need to allow the extraction of steam at a temperature/pressure suitable for raising the flow temperature in a district heating network to 110°C. The ratio of lost electricity output to useful heat output must be provided for the turbine (analogous to the coefficient of performance for a heat pump).

It will also be necessary to identify a route for district heating pipework to run to the perimeter of the site. The route needs to be sufficiently wide for flow and return pre-insulated steel pipes, of sufficient internal diameter to allow the export of the full heat output of the plant, to be accommodated and be designed in accordance with the London Heat Network Manual II. Space should also be provided to accommodate pumps and heat exchangers.

Carbon intensity floor

In line with Policy SI 8D(3), facilities generating energy from waste need to meet a minimum CO_2 equivalent emissions performance, known as a carbon intensity floor, set at 400g of CO_2 equivalent per kWh of electricity generated from waste. Generally, waste facilities operating in combined heat and power or using a high amount of biomass fuel will meet the carbon intensity floor.

Performance against the carbon intensity floor will be used to determine whether waste to energy facilities are in general conformity with Policy SI 8D(3). The GLA has developed a free tool that applicants can use to test a limited number of scenarios against the carbon intensity floor. The tool, along with more information on the carbon intensity floor and ways to meet it, can be found at https://www.london.gov.uk/what-we-do/environment/waste-and-recycling/waste-policy.

In relation to those planning applications containing proposals to generate energy from waste, the primary consideration for the energy assessment is that the electricity generation plant is designed with a heat off take facility to provide heat to an existing or future district heating network and space for heat exchangers, pumps and pipes to the edge of the site and has a costed strategy for how this will be done.

For those developments which process waste for onward product delivery, the energy assessment should only cover those buildings (or parts thereof) which are not exempt from the energy efficiency requirements of building regulations[40]. For non-exempt buildings the guidance set out in this document must be followed in line with the energy hierarchy. For the purposes of the energy assessment, process loads are classified as unregulated energy uses.

Developments generating industrial waste heat

For those planning applications relating to developments which generate surplus waste heat, for example industrial applications such as the Tate and Lyle Sugar Refinery, the primary consideration for the energy assessment is again, that the development is designed to allow the supply of heat to existing or future district heating networks. The development should identify a route for pipework to run to the perimeter of the site and space should also be provided to accommodate district heating pumps and heat exchangers.

[40] Exempt buildings include industrial buildings where the space is not generally heated other than by process heat: See Appendix C of Approved Document L2A Conservation of Fuel and Power 2013 Edition.

Other formats and languages

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