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# ENERGY PLANNING

Greater London Authority guidance on preparing energy assessments (March 2016)

**MAYOR OF LONDON**

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# SUMMARY OF GUIDANCE UPDATE

This update to the Energy Planning Guidance contains additional text aimed at:

1. Clarifying energy targets and baselines in the context of Government announcements regarding **zero carbon policy**
2. Including an overheating checklist to be completed at pre-application and submission stage to help developers and planning officers identify and address overheating risk from concept design stage;
3. Clarifying the hierarchy in London Plan Policy 5.6 and situations where CHP is or is not considered appropriate for developments

**The new guidance also includes a number of changes to technical requirements relating to:**

- **Presenting carbon emission information separately for domestic and non-domestic elements of the development in light of the zero carbon target coming into force for domestic buildings.**
  - **Provision of cooling requirement data where active cooling is required.**
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# PART 1: PURPOSE OF ENERGY ASSESSMENTS

## 1 Introduction

- 1.1 This guidance note provides further detail on how to prepare an energy assessment to accompany strategic planning applications<sup>1</sup> as set out in London Plan Policy 5.2. The purpose of an energy assessment is to demonstrate that 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.
- 1.2 For non-referable applications, London boroughs are encouraged to apply the structure for energy assessments set out in this guidance when applying development plan policy (which includes London Plan policy) and adapt it for relevant scales of development.
- 1.3 The energy assessment must fully address requirements in Policies 5.2 to 5.9 inclusive 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. Further guidance on implementing these policies is set out in the Mayor's Sustainable Design and Construction Supplementary Planning Guidance (SPG)<sup>2</sup>. The SPG provides detailed guidance on site layout and design, and energy and CO<sub>2</sub> emissions. All applicants must refer to and comply with the SPG when preparing the final energy assessment.
- 1.4 The energy assessment must clearly outline the applicant's commitments in terms of CO<sub>2</sub> savings and measures proposed. It is also important to consider and mitigate any potential air quality impacts arising as a result of technologies proposed. Part 2 of this document provides guidance on details required within an energy assessment.
- 1.5 Each application is considered on its merits, taking into account the individual characteristics of the development. Case-specific energy comments for each development are provided at Stage 1 and 2 of the GLA planning process. 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
  - commit to reducing regulated CO<sub>2</sub> emissions below those of a Part L 2013 of the Building Regulations compliant development through energy efficiency measures alone
  - 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 site wide heat network to allow connection to existing or planned district heating networks identified in the area
  - commit to a single energy centre to supply the site wide heat network

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<sup>1</sup> Planning applications referred to the Mayor of London under the GLA Act 2007

<sup>2</sup> <https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/sustainable-design-and>

- where CHP is applicable, select renewable technologies that are complementary with the optimal operation of the CHP.

## 2 Planning applications

### *Outline*

- 2.1 The applicant must clearly identify whether the proposal relates to an outline or full planning application. All outline planning applications will be expected to set out an energy strategy with commitments to guide the design and development of a planning application at the detailed stages. Depending on the matters to be considered, applicants should still undertake initial feasibility work on each part of the energy hierarchy set out in this guidance to illustrate how they will minimise carbon emissions from the development. The local planning authority should secure the key energy commitments in the strategy through appropriate clauses in the section 106 agreement or through an appropriate planning condition, and require reserved matters applications to demonstrate consistency with the outline strategy.
- 2.2 The strategy must include the following:
- Estimated site-wide regulated CO<sub>2</sub> 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
  - A clear commitment to regulated CO<sub>2</sub> emissions savings compared to a Part L 2013 of the Building Regulations compliant development through energy demand reduction measures alone
  - Clear evidence that the risk of overheating has been mitigated through passive design
  - Evidence of investigation into existing or planned district heating networks that the development could be connected to, including relevant correspondence with local heat network operators
  - Commitment to a site heat network served by a single energy centre linking all apartments and non-domestic building uses, if appropriate for the development
  - Where applicable, investigations of the feasibility of installing CHP in the proposed development (if connection can't be made to an area wide network) before considering renewables
  - Large-scale developments (e.g. mixed use developments containing more than 1000 homes) which may be the catalyst for an area wide network, must:
    - Investigate the feasibility of including additional space within the energy centre and capacity within the site heat network to supply heat to nearby developments and, where applicable, existing buildings.
    - provide a feasibility assessment to ensure that CHP is optimised to meet the domestic hot water and part of the space heating demand, thereby minimising CO<sub>2</sub> emissions.
  - An initial feasibility test for renewable energy technologies and, where appropriate, commitment to further reduce CO<sub>2</sub> emissions through the use of onsite renewable energy generation

- Consideration of the impact of development phasing (where relevant) to ensure the scheme can meet future, more stringent planning or regulatory targets
- Where the London Plan required CO<sub>2</sub> improvement on a development's Part L 2013 of the Building Regulations compliant baseline is not met, the developer must provide a commitment to ensure the shortfall is met off-site using the provision established by the borough.

### *Full*

- 2.3 Full planning applications must provide the information set out in Part 2 of the Guidance. 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. The technical and economic feasibility of such measures can be influenced by the stage at which they are considered in the design process. With the supplementary planning guidance available, and the London Plan policies, energy must be integral in the design of any new development.
- 2.4 The energy assessment should also justify how the site layout, building design and passive and active measures have been chosen to minimise the CO<sub>2</sub> emissions and address the risk of overheating. The measures that should be discussed are set out in the Sustainable Design and Construction SPG.
- 2.5 The design of all applications should consider the CO<sub>2</sub> targets that are likely to be in place at the time of submission of reserved matters applications to ensure that the scheme can meet any higher planning or regulatory targets in place at the time.

## **3 Non standard applications**

### *Waste*

- 3.1 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 – see Appendix 2 – and has a costed strategy for how this will be done.
- 3.2 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<sup>3</sup>. 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*

- 3.3 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

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<sup>3</sup> 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

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. In a similar manner to the guidance set out in paragraph 11.37, 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.

## **4 Guidance on integration with supporting documents for Planning Applications**

4.1 All planning applications referred to the Mayor must include an energy assessment prepared in accordance with this guidance document; however, where other 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)
- Environmental Impact Assessment
- Air Quality Assessment (including an emissions/concentrations assessment)
- Energy master plan for the area (where this exists).

It will also be beneficial to reference generic guidance documents where appropriate, e.g. London Heat Network Manual.

4.2 All energy assessments must contain 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 floor area. It should also summarise the floor area (m<sup>2</sup>) allocated for different non-domestic uses.

## **5 Implementation of zero carbon homes (from 1 October 2016)**

5.1 London Plan policy 5.2B sets a 'zero carbon' target for residential development. This target was to align with the then expected introduction of 'zero carbon homes' through Part L of the Building Regulations. However, the Government announced<sup>4</sup> (July 2015) that it 'does not intend to proceed with the zero carbon allowable solutions carbon offsetting scheme, or the proposed 2016 increase in on-site energy efficiency standards, but will keep energy efficiency standards under review'. Prior to this (March 2015), as part of the Housing Standards Review, through a Written Ministerial Statement, the Government set out that it expected local planning authorities not to set conditions with requirements above a Code Level 4 equivalent (around 19% improvement on Part L 2013).

5.2 However, the London Plan policy seeking 'zero carbon' homes remains in place and was not changed by the recent Minor Alterations to the London Plan. 'Zero carbon' was tested

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<sup>4</sup> Productivity Plan - Fixing the foundations: creating a more prosperous nation. July 2015  
<https://www.gov.uk/government/publications/fixing-the-foundations-creating-a-more-prosperous-nation>

through the needs and viability assessment<sup>5</sup> for the original Alteration and the assessment indicated that the standards would not compromise housing viability. This approach is required to ensure the development industry in London is prepared for the introduction of 'Nearly Zero Energy Buildings' by 2020<sup>6</sup>.

### *Definition*

- 5.3 'Zero carbon' homes are homes forming part of major development applications where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site<sup>7</sup>. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere (in line with policy 5.2E).

### *Implementation*

- 5.4 In line with the implementation date for previous increases in the London Plan carbon dioxide targets and improvements to Part L of the Building Regulations, the 'zero carbon' target as defined above will be implemented for Stage 1 schemes received by the Mayor on or after the 1st October 2016.
- 5.5 The technical implementation of this policy should be in line with this guidance document. The Mayor's Housing Standard's Viability Assessment assumed a carbon off-set price of £60 per tonne of carbon dioxide for a period of 30 years. Where the borough applies a carbon dioxide off-set price of £60 per tonne, it is not considered necessary for boroughs to carry out a further viability assessment of the policy approach.

## **6 Non-residential development carbon dioxide targets**

- 6.1 For the period 2016 to 2019, London Plan policy 5.2B sets the carbon dioxide emissions target for non-residential development to be in line with Part L of the Building Regulations. This target was intended to align with the then expected improvement to Part L of the Building Regulations. However, as stated above, the Government announced<sup>8</sup> (in July 2015) that it does not intend to proceed with the proposed 2016 increase in on-site energy efficiency standards, but will keep energy efficiency standards under review.

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<sup>5</sup> Greater London Authority Housing Standards review: Viability Assessment. May 2015  
[file:///homedata/home\\$/cgiusti/Downloads/Housing%20Standards%20Viability.pdf](file:///homedata/home$/cgiusti/Downloads/Housing%20Standards%20Viability.pdf)

Greater London Authority Housing Standards review: Evidence of Need. May 2015  
[file:///homedata/home\\$/cgiusti/Downloads/Housing%20Standards%20-Evidence%20of%20need.pdf](file:///homedata/home$/cgiusti/Downloads/Housing%20Standards%20-Evidence%20of%20need.pdf)

<sup>6</sup> As required by the European Energy Performance of Buildings Regulation which requires periodic review of Building Codes to ensure cost optimal review of energy efficiency standards and that all new buildings are 'nearly zero energy buildings' by 2020

<sup>7</sup> in line with policy 5.2B and the Sustainable Design and Construction SPG (April 2014) guidance on conversion of the policy to Part L 2013

<sup>8</sup> Productivity Plan - Fixing the foundations: creating a more prosperous nation. July 2015

<https://www.gov.uk/government/publications/fixing-the-foundations-creating-a-more-prosperous-nation>

- 6.2 The London Plan policy setting out the Building Regulations target for non-residential development remains in place and was not changed by the recent Minor Alterations to the London Plan. However, a needs assessment and feasibility and viability study<sup>9</sup> for the originally proposed Alteration tested a 50 per cent carbon reduction target<sup>10</sup> for non-domestic development and showed that for a number of non-residential development types a 50 per cent carbon reduction target (beyond Part L 2013) would be technically feasible. The study also found that for most locations a 50 per cent target would be financially viable.
- 6.3 Whilst the target set out in policy 5.2B sets the Building Regulations as the target, part A of the policy seeks to minimise carbon dioxide emissions. The Energy Planning Policies Monitoring Report shows that for 2014 Stage 2 developments referred to the Mayor that they would achieve a 40% improvement beyond Part L 2010. The small number (seven) of schemes assessed against Part L 2013 showed a 37 per cent reduction in carbon dioxide emissions beyond the Building Regulations.
- 6.4 Given the above evidence and that policy 5.2B's emission reduction targets for non-domestic uses were intended to ensure a smooth trajectory towards a zero carbon standard, and the upcoming requirement for 'Nearly Zero Energy Buildings' by 2020<sup>11</sup> the GLA will continue to require that non-domestic development seek to achieve a 35 per cent reduction against Part L 2013.

### *Implementation*

- 6.5 Same as for domestic above (5.4 and 5.5).

### *Summary*

- 6.6 To summarise, the emission reduction targets the GLA will apply to applications are as follows:
- **Stage 1 schemes received by the Mayor up until 30 September 2016** – 35% below Part L 2013 for both residential and commercial development.
  - **Stage 1 schemes received by the Mayor on or after the 1st October 2016**– Zero carbon (as defined in section 5.3 of this guidance) for residential development and 35% below Part L 2013 for commercial development

<sup>9</sup> Greater London Authority Non-Domestic Carbon Dioxide Emissions Target: Feasibility and Viability Study. May 2015  
[file:///homedata/home\\$/cgiusti/Downloads/Feasibility%20and%20viability%20study%20non%20domestic%20main%20report%20\(1\).pdf](file:///homedata/home$/cgiusti/Downloads/Feasibility%20and%20viability%20study%20non%20domestic%20main%20report%20(1).pdf)  
[file:///homedata/home\\$/cgiusti/Downloads/Feasibility%20and%20viability%20study%20non%20domestic%20main%20report%20\(2\).pdf](file:///homedata/home$/cgiusti/Downloads/Feasibility%20and%20viability%20study%20non%20domestic%20main%20report%20(2).pdf)

Greater London Authority Housing Standards review: Evidence of Need. May 2015

[file:///homedata/home\\$/cgiusti/Downloads/Housing%20Standards%20-Evidence%20of%20need.pdf](file:///homedata/home$/cgiusti/Downloads/Housing%20Standards%20-Evidence%20of%20need.pdf)

<sup>10</sup> Beyond Part L 2013

<sup>11</sup> As required by the European Energy Performance of Buildings Regulation which requires periodic review of Building Codes to ensure cost optimal review of energy efficiency standards and that all new buildings are 'nearly zero energy buildings' by 2020

# **PART 2: STRUCTURE AND CONTENT OF ENERGY ASSESSMENTS**

## 7 Executive summary

- 7.1 This must be a non-technical summary setting out and committing to the key measures and CO<sub>2</sub> reductions identified as part of the application 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 carbon reduction targets for new buildings.
- 7.2 For applications received by the Mayor on or after 1<sup>st</sup> October 2016 the regulated carbon dioxide emissions reduction target for domestic development is zero carbon and 35 per cent beyond Part L 2013 of the Building Regulations for non-domestic development.
- 7.3 Where the targets cannot be met on-site, a commitment to ensure the shortfall is met off-site using the provision established by the borough must be made (see Tables 2 and 5 for calculations to determine the shortfall). Further information on carbon dioxide offsetting is contained in the SPG<sup>12</sup>, as well as later in this guidance.
- 7.4 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<sub>2</sub> emissions compared to a development that complies with Part L 2013 of the Building Regulations. In the example, it can be seen that the development exceeds Building Regulations compliance through energy efficiency alone, with further reductions achieved through CHP and renewable energy to comply with the London Plan target.

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<sup>12</sup> <https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/sustainable-design-and>

Figure 1: The Domestic Energy Hierarchy

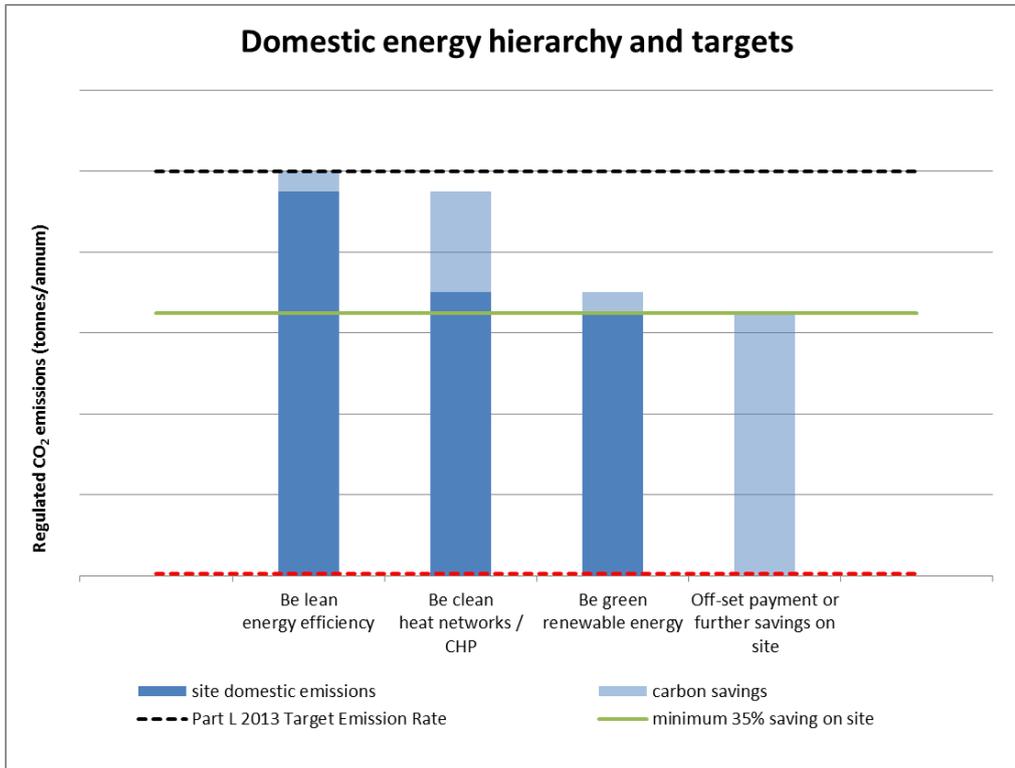
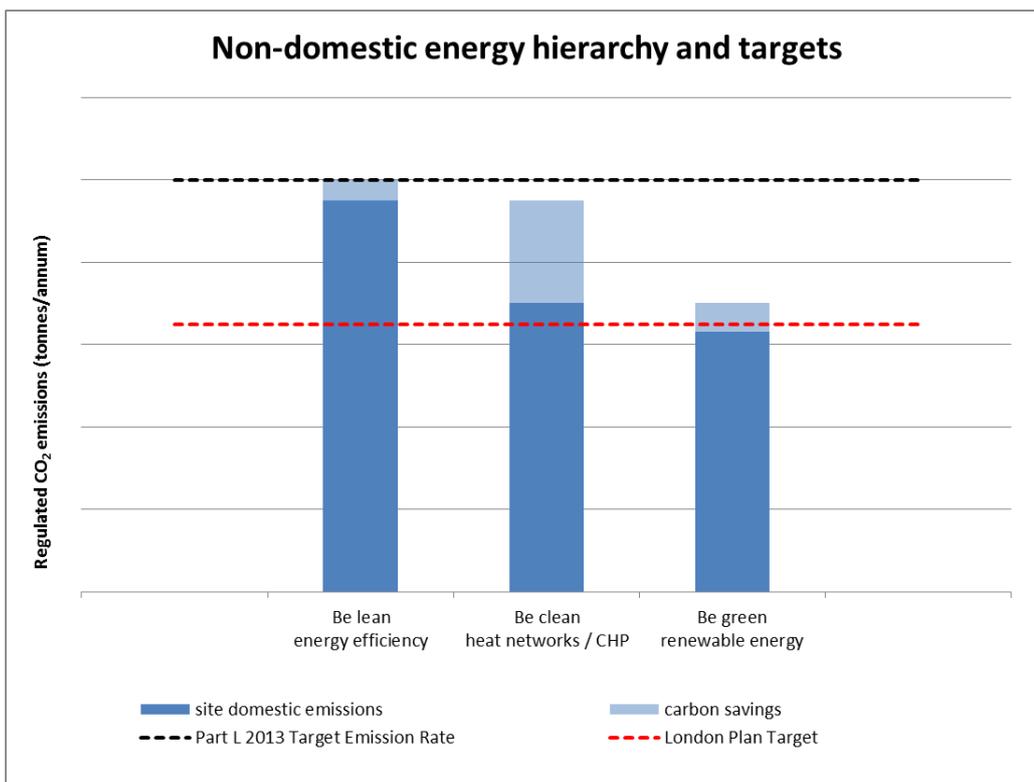


Figure 2: The Non-domestic Energy Hierarchy



- 7.5 Completion of the following tables must be undertaken to demonstrate compliance with the energy hierarchy and the carbon targets. Note: unregulated emissions are likely to be the same after the first stage of the energy hierarchy.

### *Domestic*

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon dioxide emissions for domestic buildings (Tonnes CO <sub>2</sub> per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	A	
After energy demand reduction	B	
After heat network / CHP	C	
After renewable energy	D	

Please note that savings are to be expressed in **tonnes of CO<sub>2</sub> per annum**, not kgCO<sub>2</sub>/m<sup>2</sup> per annum.

Table 2: Regulated carbon dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO <sub>2</sub> per annum)	(%)
Savings from energy demand reduction	A - B	(A - B)/A * 100
Savings from heat network / CHP	B - C	(B - C)/A * 100
Savings from renewable energy	C - D	(C - D)/A*100
<b>Cumulative on site savings</b>	<b>A - D = E</b>	<b>(A - D)/A*100</b>
Annual Savings from off-set payment	<b>-A - E = F</b>	
	<b>(Tonnes CO<sub>2</sub>)</b>	

<b>Cumulative savings for off-set payment</b>	<b>F * 30 years = G</b>	
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- 7.6 If the carbon savings are not achieved all on site, 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<sup>13</sup> to determine the required cash-in-lieu contribution.

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<sup>13</sup> Set by the local authority

**Non-domestic**

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO <sub>2</sub> per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	A	
After energy demand reduction	B	
After heat network / CHP	C	
After renewable energy	D	

Table 4: Regulated carbon dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO <sub>2</sub> per annum)	(%)
Savings from energy demand reduction	A - B	$(A - B)/A * 100$
Savings from heat network / CHP	B - C	$(B - C)/A * 100$
Savings from renewable energy	C - D	$(C - D)/A * 100$
<b>Total Cumulative Savings</b>	<b>A - D = E</b>	<b><math>(A - D)/A * 100</math></b>

7.7 Table 5 must also be completed if the non-domestic development fails to meet the 35 per cent target. Similarly to the domestic off-set arrangement, in this case the annual shortfall is determined by subtracting the overall regulated carbon dioxide savings from the target savings. The result is then multiplied by 30 years to give the cumulative shortfall, which is multiplied by the carbon dioxide offset price to determine the required cash-in-lieu contribution.

Table 5: Shortfall in regulated carbon dioxide savings

	Annual Shortfall (Tonnes CO <sub>2</sub> )	Cumulative Shortfall (Tonnes CO <sub>2</sub> )
<b>Total Target Savings</b>	$A * 0.35 = F$	
Shortfall	$F - E = G$	$G * 30 = H$

*Site total*

Table 6: Site wide regulated carbon dioxide emissions and savings

	Total regulated emissions (Tonnes CO <sub>2</sub> /year)	CO <sub>2</sub> savings (Tonnes CO <sub>2</sub> /year)	Percentage saving (%)
Part L 2013 baseline	A domestic + A non-domestic		
Be lean	B domestic + B non-domestic	Total A – Total B	(Total A – Total B)/Total A * 100
Be clean	C domestic + C non-domestic	Total B - Total C	(Total B – Total C)/Total A * 100
Be green	D domestic + D non-domestic	Total C – Total D	(Total C – Total D)/Total A * 100
		<b>CO<sub>2</sub> savings off-set (Tonnes CO<sub>2</sub>)</b>	
Off-set		G domestic + H non-domestic	

**8 Establishing CO<sub>2</sub> emissions**

- 8.1 The energy assessment must clearly identify the carbon footprint of the development after each stage of the energy hierarchy. Regulated emissions must be provided and, separately, those emissions associated with uses not covered by Building Regulations i.e. unregulated energy uses. **The figures for the domestic elements of development should be presented separately from the non-domestic elements as domestic buildings now have a different policy target to non-domestic.**

### *Calculating regulated CO<sub>2</sub> emissions for a Part L 2013 of the Building Regulations compliant development*

- 8.2 The energy assessment must first establish the regulated CO<sub>2</sub> 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 the heating would be provided by gas boilers and that any active cooling would be provided by electrically powered equipment.
- 8.3 For each non-domestic building the building's Target Emissions Rate (TER) should be multiplied by its floor area to provide the related regulated CO<sub>2</sub> 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<sub>2</sub> emissions. The CO<sub>2</sub> emissions for each non-domestic building and dwelling type are then summed to give the total regulated emissions for the development.
- 8.4 The carbon dioxide emissions factors used in the energy assessment must be those adopted for Part L 2013 of the Building Regulations, as set out in Table 12 of SAP2012. While it is recognised that the carbon factor from grid electricity may fluctuate significantly during the lifetime of the development, the approach adopted for energy assessments is to use the value which has been adopted within Building Regulations at the time of the application for planning permission.
- 8.5 Note: Compliance with any planning condition imposing a requirement to achieve future CO<sub>2</sub> reductions should be assessed against the building regulations (and hence carbon factors) in place at the time the condition was imposed.
- 8.6 As shown in Tables 2 and 4, 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<sub>2</sub> emissions.

### *Calculating regulated CO<sub>2</sub> emissions at each stage of the energy hierarchy*

- 8.7 Regulated emissions, which include the energy consumed in the operation of the space heating/cooling and hot-water systems, ventilation, internal lighting, must be calculated. Separately, unregulated emissions i.e. those relating to cooking and all electrical appliances and other small power, should be calculated.

### 8.8 Emissions for **dwelling**s must establish:

- a Dwelling CO<sub>2</sub> Emissions Rate (DER) calculated through the Part L 2013 of the Building Regulations methodology SAP 2012<sup>14</sup>. This is multiplied by the cumulative floor area for the particular dwelling type in question to give the related CO<sub>2</sub> emissions
- separately, emissions associated with non Building Regulation elements (i.e. cooking and appliances) established by using BREDEM (BRE Domestic Energy Model) or similar methodology.

In terms of the extent of modelling work required, the applicant must provide information for a representative sample of domestic properties.

### 8.9 Emissions for **non-domestic** development must establish:

- a Building CO<sub>2</sub> Emissions Rate (BER) calculated through the Part L 2013 of the Building Regulations methodology based on the National Calculation Methodology (NCM) and implemented through SBEM<sup>15</sup> v5.2d or later or equivalent software<sup>16</sup>. For each building, the related BER is multiplied by its floor area to give the related carbon dioxide emissions
- additional emissions associated with non Building Regulation elements established by using individual end use figures (for example catering and computing) from CIBSE guide baselines (e.g. CIBSE Guide F) or evidence established through previous development work.

8.10 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.

8.11 The CO<sub>2</sub> emissions for each non-domestic building should be summed together to give total non-domestic regulated emissions. Similarly the CO<sub>2</sub> 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.

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

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<sup>14</sup> SAP is the Government's Standard Assessment Procedure for Energy Rating of Dwellings. SAP 2012 is adopted by government as part of the UK national methodology for calculation of the energy performance of buildings. It is used to demonstrate compliance with building regulations for dwellings - Part L (England and Wales)

<sup>15</sup> Simplified Building Energy Model

<sup>16</sup> other building regulation compliance software such as IES or TAS is also acceptable

## **9 Calculating regulated CO<sub>2</sub> emissions for refurbishments**

- 9.1 For projects where an existing building or group of buildings is refurbished it is still expected that developers provide an energy assessment demonstrating how the individual elements of the energy hierarchy have been implemented within the project and how reductions in regulated CO<sub>2</sub> emissions have been achieved.
- 9.2 Where significant refurbishments are being carried out, it is expected that an estimate of the CO<sub>2</sub> savings from the refurbishment of the building is provided. To provide this, firstly the regulated CO<sub>2</sub> emissions of the unrefurbished, existing building should be modelled using building regulations compliance software to determine a BER/DER, which will be used to determine a baseline. The BER/DER of the refurbished building should also be determined at each stage of the energy hierarchy using building regulations compliance software. These figures should then be used to report the CO<sub>2</sub> savings at each element of the energy hierarchy in the format of Table 2 and 4 above.
- 9.3 For developments consisting of a refurbishment with a new build extension the CO<sub>2</sub> savings for the new and refurbished elements should be presented separately within the energy strategy, making clear how the new build element is performing against current standards.
- 9.4 The new build elements should be assessed in line with the methodology given in 8.2 to 8.11 and will be expected to comply with London Plan energy policy. With regards to the refurbished elements, it is appreciated that the nature and level of carbon savings that can be achieved can vary considerably, however every effort should be made to improve the energy performance of the building and follow the energy hierarchies in Policy 5.2 and 5.6 of the London Plan.

## **10 Demand reduction (Be Lean)**

- 10.1 It is technically possible to exceed Building Regulations requirements (Part L 2013) through demand reduction measures alone (see figures 1 and 2) and it is an expectation that all applications referred to the Mayor will achieve this. Energy assessments must therefore set out the demand reduction measures specific to the development and demonstrate the extent to which they meet and then exceed Building Regulations. Measures typically include both architectural and building fabric measures (passive design) and energy efficient services (active design), as described in the SPG. Introducing demand reduction features is encouraged at the earliest design stage of a development.

### *Demonstrating CO<sub>2</sub> savings from demand reduction measures*

- 10.2 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 this document. Active design measures, including high efficiency lighting and efficient mechanical ventilation with heat recovery, must be set out in the energy assessment.

- 10.3 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<sup>17</sup> divided by the façade area (multiplied by 100), should be clearly stated within the energy assessment.
- 10.4 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<sub>2</sub> Emissions Rate (TER)<sup>18</sup> before the inclusion of CHP and renewables.
- 10.5 So the improvements from energy efficiency alone can be understood, 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 CHP 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. The boilers should be assumed to have an efficiency of 89.5% for residential and 91% for non-residential and controls aligned with the Part L notional building assumptions. Higher efficiencies should only be used if gas boilers will be part of the final strategy (i.e. after the 'be clean' and 'be green' tiers of the hierarchy have also been addressed), in which case the gross efficiency of the gas boiler model to be specified can be used. If a communal heating system is being proposed, this should be included within the modelling for the 'be lean' case (i.e. the energy supply for a large apartment block would be provided by communal gas boilers not individual ones in each dwelling).
- 10.6 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 CHP 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).
- 10.7 The assessment should also set out the plans for inclusion of smart meters in the development to support the growth of demand side response. This will help enhance understanding of the potential for turning off non-essential equipment or options to allow running some equipment at a lower capacity during times of peak demand.

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<sup>17</sup> From the inside looking out

<sup>18</sup> The Target CO<sub>2</sub> Emissions Rate is the minimum energy performance requirement for a new dwelling/building. It is expressed in terms of kgCO<sub>2</sub> per m<sup>2</sup> of floor area per year

## 11 Heating infrastructure (Be Clean)

- 11.1 Once demand for energy has been minimised, all planning applications must demonstrate how their energy systems have been selected in accordance with the order of preference in Policy 5.6B. Energy assessments will need to explicitly work through the order of preference and where an approach is not appropriate for the development the assessment must provide reasoned justification, as set out in the SPG.

### *Connection to area wide low carbon heat distribution networks*

#### Existing networks

- 11.2 The applicant must investigate, making reference to the London Heat Map<sup>19</sup> and by contacting the local borough and/or local heat network operators, the potential for connecting the development to an existing heat network system. 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, the Bunhill energy centre and heat network and the University College London and Bloomsbury networks. This list is not exclusive, and it may be that other developments in the vicinity have heat networks with spare capacity that it may be viable to connect to.
- 11.3 Where a heat network exists in the vicinity of the proposed development, the applicant must prioritise connection and provide evidence of correspondence with the operator as an appendix to the energy assessment. This must include confirmation or otherwise from the network operator that the network has the capacity to serve the new development, together with supporting estimates of installation cost and timescales for connection.
- 11.4 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 heat efficiency and the type of fuel used should all be provided. Where CHP is used as a heat source, the power efficiency should also be provided.

#### Planned networks

- 11.5 If no existing network is present, the applicant must investigate whether such a network is planned in the area. Reference must be made to the relevant borough's heat mapping report (available to download at [www.londonheatmap.org.uk](http://www.londonheatmap.org.uk)) as well as energy master plans or similar studies carried out involving the borough (e.g. Royal Docks). Enquiries should also be made to appropriate contacts within the relevant borough. Examples of planned networks include Vauxhall Nine Elms Battersea and Euston Road network. Where a network is planned, developments must demonstrate that they are designed to connect to the future district heating networks. The London Heat Network Manual (available at

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<sup>19</sup> [www.londonheatmap.org.uk](http://www.londonheatmap.org.uk)

www.londonheatmap.org.uk) provides further information on designing developments to allow connection to district heating networks.

- 11.6 Section 9.2 of the London Heat Network Manual contains guidance on an approach that can be adopted when a new development falls within an energy master plan area (EMP) that proposes a district heating network.
- 11.7 Where a development is within an area that could be supplied by a district heating network but the applicant is contending that providing a site heat network to allow future connection will result in uneconomic costs to end users, the applicant must provide a whole life cost (WLC) analysis comparing the communal and individual systems. See Appendix 1 for further details of how this must be approached. Although WLC results will vary on a case by case basis, modelling usually shows that WLC of well-designed heat networks and individual boilers are broadly similar for high density developments. Where the WLC of the site heat network is broadly similar to that of individual gas boilers the network will **not** be considered to result in uneconomic costs. Where it can be demonstrated and evidenced that the WLC of the site heat network is significantly higher than that of individual gas boilers and would undermine the development going ahead, the site heat network will be deemed uneconomic. However, the WLC analysis and assumptions will be subject to intense scrutiny before such a conclusion is drawn.
- 11.8 Whilst there may appear to be no prospect of a district heating network in the vicinity, in certain developments, for example large, mixed use developments, it may still be necessary to provide a site heat network (see below) to enable the buildings to be supplied from on-site low and zero carbon energy sources.
- 11.9 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. However, each case will be considered on its own merits.
- 11.10 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 compared to apartments. They also have a higher cost of connection.

#### Site-wide heat networks

- 11.11 See the glossary for definitions of site heat network and communal heating.
- 11.12 By ensuring the necessary infrastructure is in place and providing a single point of connection, a site-wide heat network served by a single energy centre helps to facilitate later connection of a development to an area-wide district heating network. It ensures that the connecting heat network infrastructure investment occurs at the construction stage, rather than retrofitting,

with its higher costs, at a later date. The higher costs of retrofitting can have a detrimental impact on the business case for making a connection and, hence, make it less likely.

- 11.13 Applicants must work on the assumption that a site heat network will be required unless it can be clearly demonstrated that it is not applicable due to local circumstances. Therefore, where multiple high density buildings are proposed and the development is located in an area that could be served by a district heating network in the future, a communal heating system must ordinarily be adopted with all apartments and non-domestic buildings/uses within the development connected into a single site wide heat network.
- 11.14 Where a development contains small commercial/retail units, i.e. total area <math><500\text{m}^2</math>, as is often the case on the ground floor of a residential tower block, it is not necessary to connect these to the site 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 air source heat pumps. Therefore, on balance, in these circumstances the small benefit in terms of carbon reduction and contribution to strategic heat network policy is not considered to outweigh the practical constraints involved in connecting to the site heat network - hence connection is encouraged, but not mandated.
- 11.15 The site heat network should be supplied from a central energy centre where all energy generating equipment, such as boilers and/or CHP, is located. As well as facilitating later connection to an area wide district heating network, this will help to ensure that, where appropriate (see paragraph 11.28 onwards for further guidance), a single larger CHP is adopted rather than multiple smaller CHP installations of equivalent capacity. This typically provides a higher electrical efficiency, helping to reduce  $\text{CO}_2$  emissions as well as reducing maintenance and operating costs. Accordingly, the energy assessment must demonstrate that enough space has been allocated for a sufficiently large energy centre. This must be clearly shown on the plan drawings of the development and the floor area in  $\text{m}^2$  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.
- 11.16 Heat network solutions will usually benefit from the inclusion of thermal storage: this provides useful balancing if CHP is used, and also helps in the case of heat from renewable and secondary heat sources that may be intermittent. At the design stage it is also recommended that careful attention be paid to ensure systems operate with low return temperatures. In line with the CIBSE Heat Networks: Code of Practice for the UK<sup>20</sup> designers should aim for maximum secondary network flow and return temperatures of 70 degrees C and 40 degrees C respectively.
- 11.17 Networks that will be implemented in a number of phases, and where a number of energy centres are proposed, must seek to minimise the number of energy centres and explain how such an approach will be implemented across the development's phasing programme. A simple

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<sup>20</sup> <http://www.cibse.org/knowledge/cibse-other-publications/cp1-heat-networks-code-of-practice-for-the-uk>

schematic of the site heat network showing all apartments and non-domestic buildings/uses connected into it, as well as the location of the single energy centre, must be provided as part of the energy assessment. Where the development is phased, a number of schematics should be provided showing how the network will evolve, including indicative timescales if available.

- 11.18 Poorly designed heat network infrastructure within a building, e.g. a residential tower block, can contribute towards internal overheating problems and high service charges. To avoid this, developers should commit to designing and delivering communal heating systems in compliance with the CIBSE 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<sup>21</sup>.
- 11.19 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. It 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 beyond building regulation and British Standard requirements in order to stay within the heat loss levels identified in the Code of Practice. The London Heat Network Manual also provides useful guidance on the approach to be taken when specifying pipework insulation.
- 11.20 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.
- 11.21 The following scenarios provide examples of how development with different locational and other characteristics can demonstrate a policy compliant response in relation to site wide heat networks.

#### Scenario 1: Development in areas where an area heat network is planned

##### i) Development in areas where there are established plans for district heating

- 11.22 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<sup>22</sup>, the development should incorporate a site wide heat network but should not incorporate on-site CHP or other low carbon generation heat source. Unless the development itself is of a scale that it will be the catalyst for the implementation of the area wide heat network. It is expected

<sup>21</sup> <http://www.heattrust.org/index.php>

<sup>22</sup> Equivalent to cases B and C in section 9.2 of the London Heat Network Manual

that gas boilers would be installed as the temporary heat source until the development connects to the heat network.

11.23 Although an on-site low carbon heat technology<sup>23</sup> does not form part of the energy strategy in these circumstances, the 35 per cent CO<sub>2</sub> reduction 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 point must be agreed by which connection must be made. This could be set in a number of ways:

- A stated number of years following occupation of the development
- A particular date
- An agreed trigger point, e.g. occupation of the Xth dwelling.

11.24 If connection is not made by the agreed point, the developer must either:

- Install an on-site low carbon generation heat source to achieve the CO<sub>2</sub> reductions originally envisaged from connection to the heat network;
- Pay a cash-in-lieu contribution to the Borough. The value of the contribution should be the product of the envisaged CO<sub>2</sub> reductions from connection to the heat network and the price of CO<sub>2</sub> applied by the Borough; or
- A combination of the above two options.

11.25 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 S106 agreement for the development.

ii) Development in areas where a heat network is feasible but no firm plans exist

11.26 Developers will be expected to provide a site heat network served by a single energy centre in order to future proof the development for easy connection to a wider heat network in the future. The type of heat source to be installed in the energy centre (e.g. CHP, heat pumps, boilers) will depend on the technical feasibility of different low carbon heat technologies and the carbon savings being targeted. The scale and mix of uses on site will impact on the feasibility of different technologies. Paragraph 11.28 and beyond provides specific information on the feasibility of CHP.

Scenario 2: Development in areas where an area heat network is NOT proposed

11.27 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. 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

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<sup>23</sup> On-site low carbon heat technology could include CHP but it is not limited to it.

development located in close proximity to a waste heat source) or medium to large scale residential led, mixed use developments.

### ***Combined Heat and Power (CHP)***

11.28 CHP is one of various technology options that could be selected to produce the heat to serve heat networks. The consideration of whether or not on-site CHP is an appropriate energy solution for a development will depend on the type and size of the development and whether a heat network is planned in the area.

11.29 The following types of development will be expected to include on-site CHP as part of their energy strategy to meet the London Plan CO<sub>2</sub> reduction targets:

- **Medium-large residential led, mixed use developments** (e.g. containing circa 500 apartments or more). In this case CHP should be the lead heat source for a site heat network, with top-up boiler plant meeting the peak demands. Around this scale of mixed use development, it becomes economic for energy services providers to deliver the scheme as they are able to achieve a satisfactory financial return<sup>24</sup>. This arrangement provides a straightforward route for organising electricity sales and managing plant operation and maintenance. It is also worth noting that as the scale of the development increases, the capacity of appropriately sized CHP will be higher, leading to higher electrical efficiencies and greater carbon savings. Consideration should be given to other development taking place in the vicinity and whether there is the opportunity to size the CHP to provide heat beyond the immediate site boundary.

Note: the '500 apartments' figure is not fixed and is provided to give an indication of the size of development which may be of interest to an energy services provider. In certain circumstances, for example, if there is a large non-domestic component to the development, it may be expected that CHP will be installed in developments with fewer than 500 dwellings.

- **Non-domestic developments with a simultaneous demand for heat and power for in excess of 5,000 hours per annum**<sup>25</sup>. Providing a development has a substantial coincidence of demand for heat and power for the majority of hours in the year and the heat to power ratio is low (e.g. 1:1), such developments present an ideal candidate for CHP. Examples of such buildings include hotels, hospitals, and university halls of residence, leisure centres and prisons.

11.30 The following types of development need not install on-site CHP:

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<sup>24</sup> DECC Research into barriers to deployment of district heating networks (March 2013) pp32

<sup>25</sup> Carbon Trust CHP in Buildings (2004), page 20

- **Small-medium residential developments** (e.g. containing fewer than 500 apartments). At this scale it is generally not economic to install CHP in residential led, mixed use developments (and where CHP is installed it tends to have lower electrical efficiencies). Due to the small landlord electricity demand, CHP installed to meet the base heat load would require the export of electricity to the grid. However, the administrative burden of managing CHP electricity sales at this small scale where energy service companies (ESCOs) are generally not active, and the low unit price available for small volumes of exported CHP electricity, means it is generally uneconomic for developers to pursue. This can lead to CHP being installed but not operated.

Note: There may be particular circumstances where CHP is justified in smaller mixed developments (e.g. 350 units) where there is a more substantial non-domestic building space. This provides an on-site electricity demand which can straightforwardly be supplied by CHP electricity, leading to improved economics of the scheme. In situations such as this, where CHP is proposed in small developments, evidence should be provided to demonstrate that the long-term ownership model and management arrangements for the system have been fully considered. For example, this may include evidence of communication with ESCOs or management companies, or evidence that a similar approach has been applied successfully on other schemes of a similar size and type.

CHP sized to serve developments of this scale would still need to meet the emissions standards in Appendix 7 of the SPG on Sustainable Design and Construction. This may be difficult as technologies used at small CHP electrical capacities can produce greater NOx emissions per unit of measurement and are also less able to justify the capital and operating costs arising from abatement equipment.

- **Non-domestic developments with a simultaneous demand for heat and power for less than 5,000 hours per annum.** Examples of such developments may include offices and schools.

- 11.31 CHP will not be applicable in these circumstances; however the 35 per cent CO<sub>2</sub> reduction target will still apply to the new development. Therefore, developers should maximise carbon savings from additional on-site measures, including fabric energy efficiency and renewable technologies and, where these are exhausted, meet any shortfall through a cash-in-lieu contribution with the local borough.
- 11.32 Developments falling under the last two bullet points in locations where no heat networks are planned would not be expected to install a site heat network (as there is no prospect of connecting to an area heat network). In these circumstances building/dwelling specific heating technologies, such as individual gas boilers or heat pumps, would be acceptable.

- 11.33 Where CHP is not suitable for a development, additional CO<sub>2</sub> savings should be sought from renewables in addition to maximising energy efficiency measures through the development design. Any shortfall in meeting the target would be the subject of a cash-in-lieu contribution.

*Information required where CHP is applicable*

- 11.34 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.
- 11.35 In line with the London Plan energy hierarchy, where CHP is applicable, the size of the CHP must be optimised based on the thermal load profile before renewable energy systems are considered for the site. CO<sub>2</sub> savings from the CHP must be expressed as a percentage reduction on the regulated emissions of the Part L 2013 compliant development.
- 11.36 Cross referencing the Air Quality Assessment, the energy assessment should confirm that the NO<sub>x</sub> 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. 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.
- 11.37 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.
- 11.38 In certain circumstances, in line with Policy 5.8, innovative technologies are encouraged to reduce CO<sub>2</sub> emissions. Hence, there may be circumstances where innovative technologies, for example heat pumps using industrial waste heat as their heat source, are used instead of CHP as the lead heat source for a site heat network. This is likely to become more relevant as low temperature heating systems become more common making waste heat recovery more effective.

*Waste to energy plants*

- 11.39 Some developments whose purpose is to process waste will also produce fuel (e.g. bio gas) and combust the fuel to produce electricity. 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.

11.40 Further information on the relevant requirements is provided in Appendix 2.

### *Supplying CHP heat beyond the site boundary*

11.41 In line with Policy 5.6A, where CHP is proposed, particularly on large developments, the applicant should investigate opportunities for supplying heat outside the site boundaries. If CHP could be made feasible by connecting to energy consumers beyond the site boundary then applicants are encouraged to consider this option. Applicants could look in particular for opportunities to link to existing developments to help reduce their carbon dioxide emissions and this could help developments that can't meet their carbon reduction targets on-site to meet them off-site.

11.42 Very large mixed-use developments can often be the catalyst for heat networks serving the wider area. Therefore, it is important that these developments incorporate CHP and opportunities for the export of heat are fully explored. In these circumstances, sufficient allowance should be made in sizing the energy centre and site heat network infrastructure to allow for expansion of the network to serve a wider area in the future.

## **12 Cooling and overheating**

### *The Cooling Hierarchy*

12.1 Applicants should apply the cooling hierarchy in Policy 5.9 of the London Plan to the development. Measures that are proposed to reduce the demand for cooling should be set out under the following categories:

1. **Minimising 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.
2. **Reducing the amount of heat entering the building in summer:** For example, through use of carefully designed shading measures, including balconies, louvres, internal or external blinds, shutters, trees and vegetation.
3. **Use of thermal mass and high ceilings to manage the heat within the building:** Increasing the amount of exposed thermal mass can help to absorb excess heat within the building.
4. **Passive ventilation:** For example, through the use of openable windows, shallow floorplates, dual aspect units, designing in the 'stack effect'

5. **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.

### *Overheating Risk Analysis*

12.2 This sub-section considers two related issues:

1. when and how the risk of overheating should be assessed; and
2. quantifying the active cooling load and supplying it efficiently.

### [Part L requirements to limit the effect of heat gains in summer](#)

12.3 Criterion 3 of Part L 2013 of the Building Regulations relates to limiting the effects of heat gains in summer - this is implemented for new dwellings as set out in Appendix P of SAP 2012. For non-domestic buildings this is implemented through a specific test in SBEM and other approved Building Regulation compliance tools and summarised in the BRUKL output report.

12.4 Hence, developers have to undertake certain basic overheating compliance tests in order to demonstrate compliance with Building Regulations. However, the regulations explicitly recognise that, as the test does not cover all factors influencing overheating, there is no guarantee that buildings will not overheat and developers should carry out additional design assessments. In most circumstances, it is the GLA’s expectation that dynamic thermal modelling is undertaken to demonstrate compliance with London Plan Policy 5.9.

12.5 In order to identify at an early stage whether there is likely to be an overheating risk, developers of domestic buildings should complete Section 1 of the checklist given in Appendix 5 of this document and submit it with the preliminary energy information provided to GLA at pre-app stage. Section 1 and 2 should be reviewed as the design progresses and the full checklist should be completed and included within the energy assessment submitted at stage 1 of the planning application.

### [Overheating modelling](#)

12.6 Further guidance on minimising the requirement for active cooling is provided in section 3.2.4 of the Sustainable Design and Construction SPG. Further information on avoiding overheating is also provided in Chapter 5 of the London Climate Change Adaptation Strategy.

12.7 The SPG (Paragraph 3.2.3) encourages developers to undertake dynamic modelling to assess the risk of overheating in their development. 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.
- 12.8 The dynamic thermal modelling should be in addition to any assessment of overheating risk obtained from the Part L Building Regulation compliance tools SAP and SBEM. Evidence of how the development performs against the overheating criteria should be presented along with an outline of the assumptions made (e.g. around internal gains).
- 12.9 In 2014 the CIBSE, working in conjunction with the GLA, published: Design Summer Years for London (TM49: 2014)<sup>26</sup>. 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 development is better designed for the climate it will experience over its design life.
- 12.10 Where dynamic modelling is carried out, it should be undertaken in accordance with the guidance and data sets in TM49, which are summarised below.
- 12.11 As it is impossible to prejudge the impact of warm weather conditions on a building in a general sense, overheating modelling should be conducted using three design weather years:
- 1976: a year with a prolonged period of sustained warmth.
  - 1989: a moderately warm summer (current design year for London).
  - 2003: a year with a very intense single warm spell.
- 12.12 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 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. For development within:
- the Greater London Authority Central Activity Zone (CAZ) and other high density urban areas (e.g. Canary Wharf): London Weather Centre data.
  - lower density urban and suburban areas: London Heathrow airport data.
  - rural and peri-urban areas around the edge of London: Gatwick Airport data.
- 12.13 CIBSE guide TM52 contains additional guidance on the limits of thermal comfort. Entitled 'The Limits of Thermal Comfort: Avoiding Overheating in European Buildings', 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 it is recommended that this is considered when carrying out modelling.

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<sup>26</sup> <http://www.cibse.org/knowledge/cibse-tm/tm49-design-summer-years-for-london-new-2014>

*Active cooling*

- 12.14 Where design measures and the use of natural and/or mechanical ventilation are not enough to guarantee the occupant's comfort (in line with the cooling hierarchy set out in London Plan Policy 5.9), the developer should identify the cooling requirement of the different elements of the development in the energy assessment document. Note: 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 electric chiller plant but the cooling energy supplied by the chiller.
- 12.15 For residential development, where cooling equipment will be installed to meet the active cooling requirements of dwellings, the average monthly cooling requirement for the month of July for the modelled dwellings (including worst case scenarios) should be extracted from row 107 in section 8c of the DER worksheets generated by the SAP2012 software. The maximum July cooling demand for the development (i.e. the output for the worst case dwelling with regards to cooling) should also be provided. These monthly kWh/m<sup>2</sup> figures should be clearly stated in tabular form in the energy assessment. The GLA requires this information to allow like-for-like comparison of schemes and for monitoring purposes.

Average domestic cooling demand for July (kWh/m <sup>2</sup> )	Maximum domestic cooling demand for July (kWh/m <sup>2</sup> )

- 12.16 If developers are carrying out dynamic thermal modelling of domestic dwellings (e.g. using IES, TAS or other software packages), the equivalent cooling demand outputs from the dynamic thermal modelling should also be reported.
- 12.17 The GLA has investigated the possibility of creating benchmarks for domestic cooling demand and the output report "Creating benchmarks for cooling demand in new residential developments" can be found on the Mayor of London website<sup>27</sup>. This report provides some useful guidance on good practice passive design measures and likely benefits in reducing cooling loads.
- 12.18 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 providing in the energy assessment a table in the format below giving the area weighted average actual and notional cooling demands for each building, as derived from the BRUKL reports. If meeting the notional

<sup>27</sup> [https://www.london.gov.uk/sites/default/files/gla\\_cooling\\_benchmarking\\_study\\_final2.pdf](https://www.london.gov.uk/sites/default/files/gla_cooling_benchmarking_study_final2.pdf)

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.

	Area weighted average building cooling demand (MJ/m <sup>2</sup> )
Actual	
Notional	

- 12.19 Furthermore, the development's active cooling strategy, if present, should be set out 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 through the use of locally available sources such as ground cooling, river/dock water cooling, etc.
- 12.20 There should be a presumption that 'comfort cooling' will not be specified in developments where it has been demonstrated that the passive or other measures proposed have successfully addressed the risk of overheating.

### 13 Renewable energy (Be Green)

- 13.1 Energy assessments should set out consideration of renewable energy technologies in line with Policy 5.7 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.
- 13.2 The GLA expects all major development proposals to include on-site renewable energy generation, where feasible. This is regardless of whether a 35% target has already being reached through earlier stages of the energy hierarchy.
- 13.3 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<sub>2</sub> emissions. The percentage CO<sub>2</sub> reduction from renewable energy should be expressed relative to the Part L 2013 regulated energy baseline (see Table 2).
- 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<sub>2</sub> 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.
- Where heat is already to be supplied by CHP, it is important that any technologies proposed complement and do not compete with CHP. For example, solar thermal (hot water) is not considered compatible with CHP as they both supply base heat demands.
- Where CHP is not applicable (and connection to a heat network is not immediately available), the applicant should explore other renewable heat sources, e.g. central heat pumps using waste heat sources, central heat pumps providing both cooling and heating, as a route to meeting the CO<sub>2</sub> reduction targets on site.
- In certain circumstances the installation of CHP may be superseded altogether by an innovative renewable technology (see paragraph 11.36). This is likely to become more relevant as waste heat recovery from sources such as transformers, London Underground, industrial processes and sewers becomes more effective, and as the electricity grid decarbonises reducing the CO<sub>2</sub> emissions savings achievable by gas CHP.

13.4 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.

13.5 For the avoidance of doubt, heat pumps are categorised under this third and final element of the energy hierarchy (not the first element, “be lean”).

## 14 Carbon offsetting

14.1 Once the GLA is satisfied that the CO<sub>2</sub> reduction targets cannot feasibly or viably be met on-site, a commitment to ensure the shortfall is met off-site using the provision established by the borough must be provided. Table 2 and 5 and the related text above provides further information on how both the annual and cumulative shortfall in tonnes of CO<sub>2</sub> savings should be calculated.

14.2 Further information on CO<sub>2</sub> offsetting, both through off-site CO<sub>2</sub> reduction projects undertaken directly by the developer or payment to an offsetting fund in liaison with the

relevant borough, is contained in the SPG. Further summary information is also contained in Appendix 4.

- 14.3 Where boroughs do not have an established price, a figure of £60/tonne for a period of 30 years should be applied as recommended in the Mayor's Sustainable Design and Construction SPG.
- 14.4 It should be noted that a cash in lieu payment should not be used as a cost comparison with delivering CO<sub>2</sub> savings on-site. Policy 5.2 requires the 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. In the case of the zero carbon target for homes, a minimum of 35% carbon savings are expected to be delivered on site. The remaining savings to reach zero carbon can be achieved either on site or via a cash in lieu contribution, although savings on site would be preferable.

## **15 Monitoring**

- 15.1 Developers are strongly encouraged to monitor energy use during the occupation of their developments. Further information on monitoring energy use can be found in the SPG. Developers should also consider incorporating technology that would enable demand side response.

# GLOSSARY

**Building Emissions Rate (BER) or Dwelling Emission Rate (DER)** - the actual building/dwelling CO<sub>2</sub> emission rate. It is expressed in terms of the mass of CO<sub>2</sub> emitted per year per square metre of the total useful floor area of the building (kg/m<sup>2</sup>/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 where heat is supplied to multiple dwellings and/or non-domestic buildings using pipes containing hot water.

**Energy assessment** - an energy assessment is a document which explains how the London Plan targets for CO<sub>2</sub> 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<sub>2</sub> emissions** - The CO<sub>2</sub> 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.

**Site 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<sub>2</sub> Emission Rate (TER)** - the minimum energy performance requirement for a new dwelling/building. It is expressed in terms of the mass of CO<sub>2</sub> emitted per year per square metre of the total useful floor area of the building (kg/m<sup>2</sup>/year).

# REFERENCES

**London Heat Network Manual (2014)** – available at:

[http://www.londonheatmap.org.uk/Content/uploaded/documents/LHNM\\_Manual2014Low.pdf](http://www.londonheatmap.org.uk/Content/uploaded/documents/LHNM_Manual2014Low.pdf)

**London Heat Map** - <http://www.londonheatmap.org.uk/>

**Sustainable, Design and Construction SPG** <https://www.london.gov.uk/what-we-do/planning/implementing-london-plan/supplementary-planning-guidance/sustainable-design-and>

# APPENDIX 1

## Required approach to whole life costing

This section provides information on how whole life costing (WLC) must be approached where the developer is claiming that adopting communal heating will result in uneconomic costs to end users. It provides broad guidance on how the WLC must be approached – individual assumptions will be subject to scrutiny.

The WLC 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 per cent 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 2

## Ensuring waste to energy plants are heat network ready

Some developments whose purpose is to process waste will also produce fuel (e.g. bio gas) 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. Space should also be provided to accommodate pumps and heat exchangers.

### Carbon intensity floor

In line with Policy 5.17B, facilities generating energy from waste need to perform better in CO<sub>2</sub> equivalent terms than the energy they are replacing to achieve a positive carbon outcome. The Mayor has developed a minimum CO<sub>2</sub> equivalent emissions performance for such facilities to achieve, known as a carbon intensity floor, set at 400g of CO<sub>2</sub> 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 5.17B. 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/priorities/environment/waste-litter>.

# APPENDIX 3

## Guidance on different types of renewable energy

### Details required in relation to biomass application and biomass emissions standards

Please refer to the Mayor's Air Quality Strategy, section 7.14 of the London Plan and relevant sections of the Sustainable Design and Construction supplementary planning guidance for more detail on air quality requirements.

Development proposals should be at least 'air quality neutral', not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs)), and create opportunities to improve local air quality. They should minimise exposure to existing poor air quality and make provision to address local problems of air quality (particularly within AQMAs and where development is likely to be used by large numbers of those particularly vulnerable to poor air quality)<sup>28</sup>.

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.

### 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.

### Details required in relation to photovoltaic applications

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

- 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

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<sup>28</sup> Clearing the air. The Mayor's Air Quality Strategy, December 2010, <http://www.london.gov.uk>

shading analysis should include an assessment of the height of existing buildings and any permissions granted for buildings near the application site.

- 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<sub>2</sub> savings that may be realised through the use of this technology.

### **Details required in relation to solar thermal**

Where the use of solar thermal collectors is considered appropriate the following information will also be required:

- 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<sub>2</sub> savings that may be realised through the use of this technology.

### **Details required in relation to ground/water source heat pumps**

Where the use of ground source heat pumps (GSHPs) is considered appropriate the following information will also be required:

- Clarification on how the GSHP will operate alongside any other heating/cooling technologies being specified for the development and alongside communal heating systems being proposed by the applicant
- An estimate of the heating and/or cooling energy the GSHP may provide to the development and the electricity the heat pump would require for this purpose.
- The estimation of the amount of heating/cooling that the GSHP may supply should be supported with 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.
- Details of the Coefficient of Performance (COP) and Energy Efficiency ratio (EER)
- An indication of the seasonal COP and EER of the heat pumps
- A calculation of the CO<sub>2</sub> savings that may be realised through the use of this technology.
- Confirmation that the site geology is suitable for ground source heat pumps.
- Also evidence of the likelihood of a permit being granted by the Environment Agency, where required.

### Details required in relation to air source heat pumps

Where the use of air source heat pumps (ASHPs) is considered appropriate the following information will also be required:

- Clarification as to how the ASHP will operate alongside any other heating/cooling technologies being specified for the development (i.e. how will the ASHP operate alongside communal heating systems, and/or combined heat and power plant, solar thermal, etc. if they are also being proposed by the applicant)
- An estimate of the heating and/or cooling energy the ASHP would provide to the development and the electricity the heat pump would require for this purpose
- Details of the Coefficient of Performance (COP) and Energy Efficiency ratio (EER) of the proposed heat pump under test conditions.
- 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 (<http://etl.decc.gov.uk>)
- 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>
- An indication of the seasonal COP and EER of the heat pumps
- A calculation of the CO<sub>2</sub> savings that may be realised through the use of this technology.

### 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<sub>2</sub> savings that may be realised through the use of this technology.

# APPENDIX 4

## Offsetting

The SPG on Sustainable Design and Construction SPG contains high level guidance for boroughs on how to establish a carbon offsetting fund and identify suitable projects to be funded.

London Plan Policy 5.2 sets out that where the required percentage improvements beyond Part L of the Building Regulations are not met on-site, any short fall should be provided off-site or through a cash-in-lieu contribution to the relevant borough.

Boroughs may agree with a developer for the developer to directly off-set 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.

To maximise the reduction in carbon dioxide emissions in London, boroughs should establish a planning related carbon dioxide reduction fund and set a price at which the carbon dioxide shortfall will be calculated.

The SPG provides further guidance on:

1. calculating the price of carbon
2. establishing an offsetting fund and identifying projects.

Note: There are important requirements relating to, for example, interactions with the Community Infrastructure Levy (CIL) and the SPG provides further information on this.

The guidance in the SPG also contains further information in relation to:

- monitoring emission reductions, and
- carbon accounting (where off-set measures are funded from multiple sources).

# APPENDIX 5

## Domestic Overheating Checklist

This checklist is intended to assist designers to identify potential overheating risk in residential accommodation early on in the design process and trigger the incorporation of passive measures within the building envelope and services design to mitigate overheating and reduce cooling demand in line with London Plan policy 5.9.

Section 1 of the checklist should be completed at the start of the design process (concept design) and should be submitted with the preliminary energy information provided to GLA at pre-app stage. Section 1 and 2 should be reviewed as the design progresses and the full checklist should be completed and included within the energy assessment submitted at stage 1 of the planning application.

Section 1 - Site features affecting vulnerability to overheating		Yes or No
Site location	Urban – within central London <sup>29</sup> or in a high density conurbation	
	Peri-urban – on the suburban fringes of London <sup>30</sup>	
Air quality and/or Noise sensitivity – are any of the following in the vicinity of buildings?	Busy roads / A roads	
	Railways / Overground / DLR	
	Airport / Flight path	
	Industrial uses / waste facility	
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	
	Are residents likely to be at home during the day (e.g. students)?	
Dwelling aspect	Are there any single aspect units?	
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	
	If yes, is this to allow acceptable levels of daylighting?	
Security - Are there any security issues that could limit opening of windows for ventilation?	Single storey ground floor units	
	Vulnerable areas identified by the Police Architectural Liaison Officer	
	Other	

<sup>29</sup> Urban - as defined in CIBSE Guide TM49. Broadly equivalent to Central Activities Zone and Inner London areas in Map 2.2 of the London Plan

<sup>30</sup> Peri-urban – as defined in CIBSE Guide TM49. Broadly equivalent to Outer London areas in Map 2.2 of the London Plan

<b>Section 2 - Design features implemented to mitigate overheating risk</b>		<b>Please respond</b>
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	
	Will green roofs be provided?	
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	
Materials	Have high albedo (light colour) materials been specified?	
Dwelling aspect	% of total units that are single aspect	
	% single aspect with N / NE / NW orientation	
	% single aspect with E orientation	
	% single aspect with S / SE / SW orientation	
	% single aspect with W orientation	
Glazing ratio - What is the glazing ratio (glazing; internal floor area) on each facade?	N / NE / NW	
	E	
	S / SE / SW	
	W	
Daylighting	What is the average daylight factor range?	
Window opening	Are windows openable?	
Window opening	What is the average percentage of openable area for the windows?	
Window opening - What is the extent of the opening?	Fully openable	
	Limited (e.g. for security, safety, wind loading reasons)	
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	
Shading	Is there any external shading?	
	Is there any internal shading?	
Glazing specification	Is there any solar control glazing?	
Ventilation - What is the ventilation strategy?	Natural – background	
	Natural – purge	
	Mechanical – background (e.g. MVHR)	
	Mechanical – purge	
	What is the average design air change rate	
Heating system	Is communal heating present?	
	What is the flow/return temperature?	
	Have horizontal pipe runs been minimised?	
	Do the specifications include insulation levels in line with the London Heat Network Manual <sup>31</sup>	

<sup>31</sup> [http://www.londonheatmap.org.uk/Content/uploaded/documents/LHNM\\_Manual2014Low.pdf](http://www.londonheatmap.org.uk/Content/uploaded/documents/LHNM_Manual2014Low.pdf)

## Other formats and languages

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### Chinese

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### Hindi

यदि आप इस दस्तावेज की प्रति अपनी  
भाषा में चाहते हैं, तो कृपया निम्नलिखित  
नंबर पर फोन करें अथवा नीचे दिये गये  
पते पर संपर्क करें

### Vietnamese

Nếu bạn muốn có văn bản tài liệu  
này bằng ngôn ngữ của mình, hãy  
liên hệ theo số điện thoại hoặc địa  
chỉ dưới đây.

### Bengali

আপনি যদি আপনার ভাষায় এই দলিলের প্রতিলিপি  
(কপি) চান, তা হলে नीचेर ফোন নম্বরে  
বা ঠিকানায় অনুগ্রহ করে যোগাযোগ করুন।

### Greek

Αν θέλετε να αποκτήσετε αντίγραφο του παρόντος  
εγγράφου στη δική σας γλώσσα, παρακαλείστε να  
επικοινωνήσετε τηλεφωνικά στον αριθμό αυτό ή ταχυ-  
δρομικά στην παρακάτω διεύθυνση.

### Urdu

اگر آپ اس دستاویز کی نقل اپنی زبان میں  
چاہتے ہیں، تو براہ کرم نیچے دئے گئے نمبر  
پر فون کریں یا دیئے گئے پتے پر رابطہ کریں

### Turkish

Bu belgenin kendi dilinizde  
hazırlanmış bir nüshasını  
edinmek için, lütfen aşağıdaki  
telefon numarasını arayınız  
veya adrese başvurunuz.

### Arabic

إذا أردت نسخة من هذه الوثيقة بلغتك، يرجى  
الاتصال برقم الهاتف أو مراسلة العنوان  
أدناه

### Punjabi

ਜੇ ਤੁਹਾਨੂੰ ਇਸ ਦਸਤਾਵੇਜ਼ ਦੀ ਕਾਪੀ ਤੁਹਾਡੀ ਆਪਣੀ ਭਾਸ਼ਾ  
ਵਿਚ ਚਾਹੀਦੀ ਹੈ, ਤਾਂ ਹੇਠ ਲਿਖੇ ਨੰਬਰ 'ਤੇ ਫੋਨ ਕਰੋ ਜਾਂ ਹੇਠ  
ਲਿਖੇ ਪਤੇ 'ਤੇ ਰਾਬਤਾ ਕਰੋ:

### Gujarati

જો તમને આ દસ્તાવેજની નકલ તમારી ભાષામાં  
જોઈતી હોય તો, કૃપા કરી આપેલ નંબર ઉપર  
ફોન કરો અથવા નીચેના સરનામે સંપર્ક સાધો.

