LONDON BOROUGH OF EALING
ENERGY STATEMENTS – WHAT THEY SHOULD INCLUDE

Purpose of Energy Statements

1. Introduction

This guidance note provides further detail on addressing the energy hierarchy[1] through the provision of an energy assessment to accompany planning applications. The purpose of an energy assessment is to demonstrate that climate change mitigation measures are integral to the scheme's design and evolution, and that they are appropriate to the context of the development.

The energy assessment should fully address requirements in Policies 5.2 to 5.9 of the London Plan 2011 and, recognising the integrated nature of London Plan policies and any local variation that will be adopted under Ealing's Development Management DPD, take account of relevant design, spatial, air quality, transport and climate change adaptation policies. It should clearly outline the applicant's commitments in terms of CO2 savings and measures proposed. A guide to details required within an assessment follows below.

It should be noted that this document follows mainly the GLA Guidance on preparing energy assessments whilst including some extra guidance on how the information should be demonstrated for ease the review and validation process.

It should be also noted that this guidance will be frequently updated based on the changes in the Building Regulations, London Plan and adoption of local variations in London Plan polices.

2. Guidance on integration with supporting documents for planning applications

An energy assessment will always be required, 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. This may include the following:

- Design and Access Statement
- Sustainability statement/ Sustainability Checklist
- Code for Sustainable Homes / BREEAM Pre-Assessment reports
- Environmental Impact Assessment
- Air Quality Assessment

All energy assessments should also contain a brief description of the proposed development. This should clearly state the number of each different type of residential units e.g. 100 flats and 15 houses. It should also summarise the floor area allocated for different non-domestic uses.

[1] Mayor's Energy Hierarchy – London Plan 2011

3. Outline and full planning applications

The applicant should 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. Ealing Council will secure 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.

The strategy should include the following:

- A target for overall CO_2 reductions
- A target for CO_2 emissions savings through energy demand reduction measures
- Commitment to communal heating infrastructure if appropriate for the development, and evidence of investigation into the existence of any wider district networks that the development could be connected to.
- Provision for future connection of the development's energy centre if the development is within the focus areas identified within Ealing's Heat Mapping Study or in a proximity to these areas.
- Investigations of the feasibility and, where viable, commit to the installation of CHP in the proposed development.
- Large-scale developments should provide a feasibility assessment to ensure that CHP is sized to minimise CO_2 emissions.
- Identification of measures to minimise unregulated emissions.
- Initial feasibility test for renewable energy and commitment to reduce CO_2 emissions further through the use of onsite renewable energy generation, where feasible

Full planning applications should provide the information set out below. Planning conditions and/or section 106 agreements should be used to secure the implementation of proposed measures, rather than secure feasibility work that should normally underpin 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 planning guidance available, and the new London Plan policies and proposed Ealing's variation on LP2011 energy policies, energy should be integral in the design of any new scheme.

4. Structure and Content of Energy Assessments

Executive Summary

This should be a non-technical summary setting out and committing to the key measures and CO_2 reductions identified as part of the application for each stage of the energy hierarchy. It should clearly indicate the performance of the development in relation to the carbon reduction targets for new buildings set out in Policy 5.2B of the London Plan 2011.

The concept of applying the energy hierarchy in relation to 2010 Building Regulations is illustrated in Figure 1 below. Where the blue bars drop below the red line, this demonstrates savings in regulated CO_2 emissions compared to a development that complies with the 2010 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.

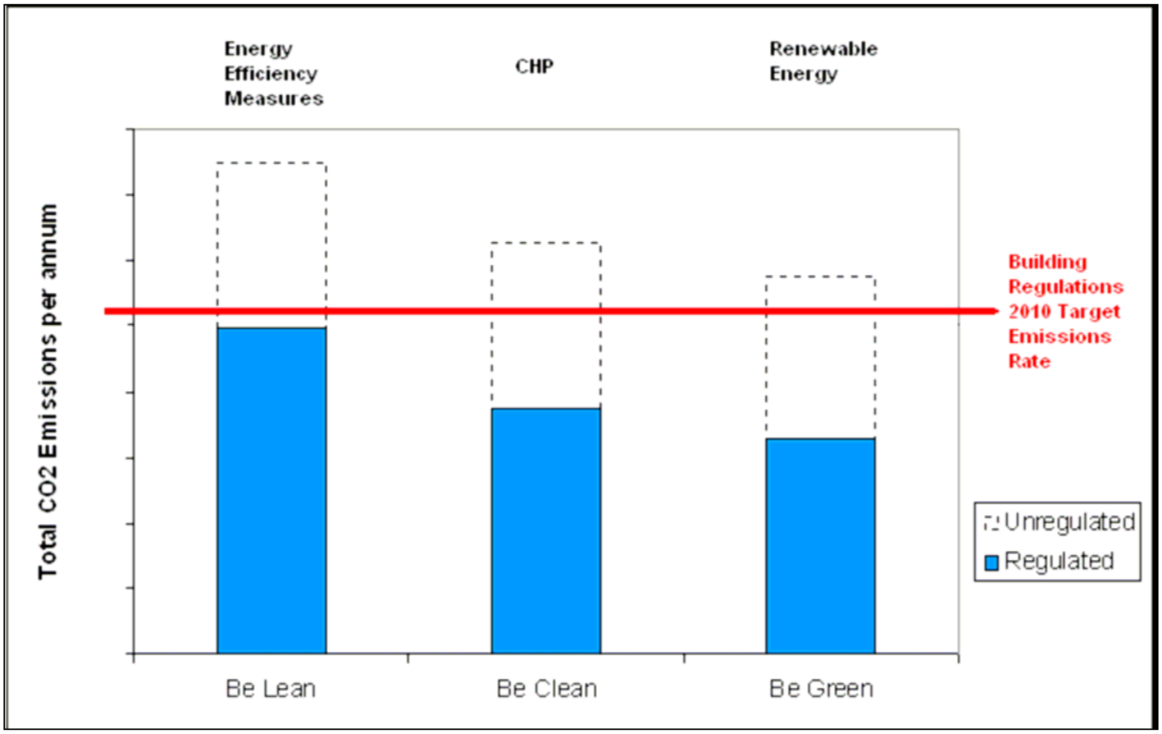

Figure 1. The Energy Hierarchy

Completion of the following tables should be undertaken to demonstrate compliance with the energy hierarchy. With regards to the unregulated emissions, these are likely to remain the same after the first stage of the energy hierarchy.

	Carbon dioxide emissions (Tonnes CO_2 per annum)		
	Regulated	**Unregulated**	**Total**
Building Regulations 2010 Part L Compliant Development	A	B	C = A + B
After energy efficiency measures reduction	D	E	F = D + E
After CHP	G	H	I = G + H
After renewable energy	J	K	L = J + K

Table 1. Carbon Dioxide Emissions after each stage of the Energy Hierarchy

	Carbon dioxide savings (Tonnes CO_2 per annum)		Carbon dioxide savings (%)	
	Regulated	Total	Regulated	Total
Savings from energy efficiency measures reduction	A - D	C - F	(A – D)/A * 100	(C - F)/C*100
Savings from CHP	D - G	F - I	(D – G)/D * 100	(F - I)/F*100
Saving from renewable energy	G - J	I - L	(G – J)/G*100	(I - L)/I*100
Total Cumulative Savings	A - J	C - L	(A – J)/A*100	(C – L)/C*100

Table 2: Carbon Dioxide Savings from each stage of the Energy Hierarchy

Please note: When presenting the summary of the carbon savings being achieved, the Mayor's proposed carbon reduction targets for new developments, outlined in the adopted London Plan 2011, should also be referenced as a material consideration till our proposed climate change policies in the LDF Development Management[2,3] (Final Proposals Consultation June 2012) to be adopted. With regards to Ealing Council's current energy policy, UDP policy 2.9, is now largely superseded by policies in the London Plan 2011. The first and last clauses of policy 2.9 are still broadly applicable, although even these are better covered by policies in the London Plan.

With regards to policy 5.2 of the London Plan 2011, the 25% reduction in CO2 over BR2010, for the period of 2010 to 2013, covers only regulated emissions and is preferred to be achieved through 'Lean' measures (passive measures).

With regards to the 20% CO2 emissions reduction from on-site renewable energy generation noted in the supporting text below Policy 5.7 of London Plan 2011, is held as a target but not a fundamental requirement. It should be noted though that this target will be sought where it is feasible and viable and where the applicant does not recommend any measures normally applied under stage 2 of the Energy Hierarchy (be clean).

This guidance will continue to be updated following the adoption of regional or local policies.

After calculating the emissions at each stage of the energy hierarchy, the percentage savings over a 2010 Building Regulations compliant development should be provided (as shown in Table 2 above).

5. Establishing CO_2 emissions

The energy assessment should clearly identify the carbon footprint of the development after each stage of the energy hierarchy. Regulated emissions should be provided and, separately, those emissions associated with uses not covered by Building Regulations (i.e. unregulated energy uses).

[2] Ealing 2026, Development Management DPD Final Proposals Consultation, June 2012
[3] Towards Zero Carbon Development in Ealing, energy evidence base, September 2010

5.1 Baseline Energy Consumption – Compliant BR Part L 2010 base case

The assessment should clearly demonstrate the breakdown of both regulated and un-regulated energy use for the compliant Part L 2010 base case.

Regulated energy consumption should be calculated through SAP[4]/SBEM[5] while providing the Dwellings Emission Rate (DER) for residential dwellings or Building Emissions Rate (BER) for non-residential.

In addition non-regulated emissions should be also measured. Additional emissions associated with non Building Regulation elements for **domestic developments** (i.e. cooking and appliances) established by using BREDEM (BRE Domestic Energy Model) or Code for Sustainable Homes guidance and **for non-domestic established** by using individual end use figures (for example catering, computing, communal and security lighting, etc) from CIBSE guide baselines (eg CIBSE Guide F), ECON 19[6], or evidence established through previous development work should be also demonstrated in the energy assessment.

A breakdown of the **Compliant Part L 2010 Carbon Dioxide (CO_2) Emissions** calculated using standard conversion factors[7,8].

- Total baseline CO_2 emissions taking into account both regulated and un-regulated emission sources.
- Baseline emissions should be calculated on a 'whole energy' basis which includes the energy consumed in the operation of the space heating/cooling and hot water systems, ventilation, all internal lighting, cooking and all electrical appliances and other small power.
- Emissions associated with water and space heating should be calculated from a gas baseline, unless an electrical baseline can be justified.

In terms of the extent of modelling work required, the applicant should provide a representative sample of domestic properties and/or a print out such as a BRUKL report for non-domestic developments should be provided in an appendix of the energy assessment.

5.2 Demand Reduction (Be Lean)

It is technically possible to exceed Building Regulations requirements (Part L 2010) through demand reduction measures alone (see figure 1). Energy assessments should therefore set out the demand reduction measures specific to the scheme and demonstrate the extent to which they exceed Building Regulations. Measures

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[4] SAP is the Government's Standard Assessment Procedure for Energy Rating of Dwellings. SAP 2009 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)

[5] Simplified Building Energy Model – other building regulation compliant software such as IES or TAS is also acceptable

[6] Energy Consumption Guide 19

[7] Available from SAP2009 - The Government's Standard Assessment Procedure & National Calculation Methodology (NCM) modelling guide 2010 (for buildings other than dwellings in England and Wales). These include:

- Natural gas: 0.198kgCO_2/kWh
- Electricity: 0.517kgCO_2/kWh
- Electricity from on-site renewable energy: 0.529kgCO_2/kWh
- Biomass : 0.028 (domestic) & 0.013 (non-domestic) kgCO_2/kWh

[8,9] See Appendix A for example templates

typically include both architectural and building fabric measures (passive design) and energy efficient services (active design). **Introducing demand reduction features is encouraged at the earliest design stage of a development.**

Demonstration of energy consumption and CO_2 emissions **reductions** resulting from the implementation of the **energy efficiency measures** over the compliant Part L 2010 base case[9]

- Provide details and any assumptions made of the energy efficiency measures that will be incorporated into the development
- Where available, specific details, such as building material U-values, ratings of electrical appliances, etc should be included.

<u>5.2.1 Demand Reduction Measures should include</u>

a. Passive design measures, including orientation and site layout, natural ventilation and lighting, thermal mass and solar shading, should already be set out in the Design and Access Statement and cross-referenced where appropriate. Active design measures, including high efficacy lighting and efficient mechanical ventilation, should be set out in the energy assessment.
b. Measures that are proposed to reduce the demand for cooling should also be set out i.e. minimisation of internal gains, night cooling, etc.
c. The applicant should provide details in the energy assessment of the demand reduction measures specific to the scheme, for example enhanced U-value numbers (W/m2K), air tightness improvement, efficient services and lighting.
d. The applicant should clearly identify the extent to which Building Regulations are exceeded through the use of these demand reduction measures alone, i.e. the percentage improvement of the BER/DER over the Target Emissions Rate (TER).
e. The appendix of the energy assessment should include a summary output sheets from the modelling work (i.e. a print out such as a BRUKL report). For applications including residential units, a clear explanation of the different dwelling types modelled should be provided.
f. The energy assessment should also set out proposals for how non-regulated energy and carbon dioxide emissions will be reduced through the use of energy efficient appliances and equipment, controls, good management practice, etc.
g. The percentage reduction in non-Building Regulations covered energy uses, along with measures undertaken, should also be provided.

5.3 Heating and Cooling Infrastructure including CHP (Be Clean)

Once demand for energy has been minimized, all planning applications should demonstrate how their energy systems have been selected in accordance with the order of preference in LP 2011 Policy 5.6. Energy assessments will need to explicitly work through the order of preference and where an approach is not appropriate for the development, the assessment should provide reasoned justification.

5.3.1 Connection to existing low carbon heat distribution networks including combined heat and power

a. The applicant should investigate, making reference to the London[10] and Ealing's[11] Heat Map and contacting the local borough or the local decentralised energy operator, if available, the potential for connecting the scheme to an existing decentralised energy system
b. The applicant should investigate the potential for connecting the scheme to an existing decentralised energy system. A back-up on-site strategy is also required in the event that connection to a decentralised energy scheme proves unviable. Where a heat network exists in the vicinity of the proposed development, evidence of correspondence with the operator should be provided as an appendix to the energy strategy.
c. If no existing scheme is present, the applicant should investigate whether such a network is planned in the area. Developments should demonstrate that they are designed to connect to future decentralised energy networks where possible (established or planned schemes may have detailed technical guidance which applicants should follow).
d. For developments occurring within an opportunity area (OA) or similar the energy assessment should confirm that the energy proposals are in line with the energy strategy for the area, if available.
e. Information related to the carbon factor associated with the heat utilised from networks should be obtained from the network operator and be provided.

5.3.2 Site wide heating networks

a. Where multiple buildings are proposed, and where building density is sufficient, a communal heating system should be adopted with all buildings/uses within a scheme normally connected into a single site-wide communal heating network, thus facilitating future connection to decentralised energy networks or use of on-site low carbon energy sources.
b. The communal heating network should be supplied from a central energy centre where all energy generating equipment is located, such as boilers, CHP etc. Accordingly, the energy assessment should demonstrate that enough space has been allocated for a sufficiently large energy centre.
c. Schemes that will be implemented in a number of phases, and where a number of energy centres are proposed, should seek to minimise the number of energy centres and explain how the energy assessment will be implemented across the development's phasing programme.
d. A simple schematic of the communal heating network showing all buildings/ uses connected into it, as well as the location of the single energy centre, should be provided as part of the energy assessment. Where the development is phased, a number of schematics should be provided showing how the network evolves over including indicative timescales if available.

[10] www.londonheatmap.org.uk
[11] http://www.ealing.gov.uk/downloads/download/563/ldf_evidence_base_heat_mapping_study

5.3.3 Combined Heat and Power (CHP)/ Combined Cooling and Heating

Demonstration of energy consumption and CO_2 emissions **reductions** resulting from supplying energy efficiently

- Illustrate in the proposal how the use of Combined Heat and Power (CHP) technology or a community / district heating scheme or centralised heating system has been explored
- This may not be applicable to all sites. If it is not applicable, give the reason why this consideration has been excluded.

a. Applicants should evaluate the feasibility of CHP.
b. Where CHP is considered feasible, a full feasibility analysis will be required including operational data and operational performance, costs, QI rating, and suitable demand profiles for heating, cooling and electrical loads[12], thermal store etc.
c. In line with the London Plan[13] energy hierarchy, the size of the CHP should be optimised based on the thermal load profile before renewable energy systems are considered for the site.
d. CO_2 savings from the CHP should be expressed as a percentage reduction on emissions after demand reduction measures have been applied to the baseline regulated emissions and then to baseline regulated and un-regulated emissions.
e. Cross referencing the Air Quality Assessment, an energy assessment should confirm that the NOx emission limits will be met in line with the Mayor's emission standards for CHP.
f. Details of the commercial operation of the CHP scheme, such as information on the how any sales of heat/power will be managed should also be provided (this is particularly important where power is being exported to the local distribution network). Details of communication with Energy Service Companies (ESCOs) should also be supplied where appropriate.
g. If CCHP (trigeneration) is considered appropriate to the development, the size of the absorption chiller to be used is required.

Please see Table 1 under Appendix B for details on the additional information required on CHP technology.

5.3.4 CHP beyond the site boundary

In line with London Plan policy 5.6A, where CHP is proposed, the applicant should provide evidence that they have investigated opportunities for extending the scheme 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.

5.3.5 Cooling

[12] See Appendix B for details on the additional information required for each technology
[13] The London Plan 2011

Proposals for reducing CO_2 emissions in energy assessments should be robust in addressing the potential risk of overheating within a building and in setting out measures that aim to minimise the need for active cooling systems. Accordingly, a low carbon cooling proposals should be developed that sets out:

1. measures that are being considered to reduce the demand for cooling in the first instance, i.e. minimisation of internal gains, minimisation of unwanted summer solar gains through the use of external shading devices, appropriate use of thermal mass, night cooling, etc.
2. the extent to which the cooling demand has been minimised
3. where the use of natural and/or mechanical ventilation is not enough to guarantee the occupants comfort the cooling proposals should include:
    - details of the cooling infrastructure being proposed
    - details of the cooling plant being proposed, including efficiencies, ability to take advantage of free cooling and/or renewable cooling sources

Where appropriate the cooling proposals should investigate the opportunities to improve cooling efficiencies through the use of locally available sources such ground cooling, river/dock water cooling, etc

5.4 Renewable energy (Be Green)

Energy assessments should set out consideration of each renewable energy[14] technology in Policy 5.7 of the London Plan 2011. All technologies listed in paragraph 5.42 of the London Plan 2011 are considered potentially technically feasible in the London Borough of Ealing. 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 and justification for those technologies not considered feasible should be included in Appendix.

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. In particular for the most suitable technologies details such as number, size and efficiency of the system(s), estimated energy generation (in kWh/yr and as a percentage), detailed drawings showing where the technology(ies) will be installed and costs should be provided.

Applicants should provide calculations to demonstrate that their chosen system or systems will reduce CO2 emissions from residual regulated emissions firstly and then residual regulated and un-regulated emissions once CO2 savings from demand reduction measures and energy efficient supply including CHP have been discounted from baseline regulated emissions.

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, 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 compliment and not compete with CHP.

[14] See Appendix B for details on the additional information required for each technology

A concluding section should be provided outlining the contribution of each set of measures, technology or combination of technologies towards meeting the relevant target and providing recommendations as to which would be more suitable for the site. Where it has not been possible to reach the target, a clear explanation should be provided.

Example formats for simple tables containing the necessary energy and CO_2 offset data are given below. These may be used to summarise the information contained in your Energy Statement.

5.4.1 Details required in relation to solar photovoltaic (PV) applications

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

1. Solar PV's specification such as collector type and area (m2), module efficiency (%) and total system efficiency (%)
2. An estimate of the annual energy generated (kWh/yr) the photovoltaic modules may generate, installed power (kWp), percentage of electricity generated including the assumptions for the calculations
3. An estimate of the capital cost, potential electricity savings and income from Feed-in-Tariffs, payback period.
4. A calculation of the CO_2 savings that may be realised through the use of this technology (kgCO2/yr and %).
5. 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 free of shading
6. Quantification of the amount of roof area that could be used to install photovoltaic modules

Please see Table 2 under Appendix B for details on the additional information required on solar PV technology.

5.4.2 Details required in relation to Solar Thermal

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

1. Consideration of their appropriateness for the development
2. Clarification to how the solar thermal collectors will operate alongside the communal heating system being proposed by the applicant
3. Solar thermal collector's specification such as collector type and area (m2) and total system efficiency (%)
4. An estimate of the annual heating requirements that the solar thermal collectors may provide (kWh/yr), percentage of DHW generated including the assumptions for the calculations
5. An estimate of the capital cost, potential fuel savings and potential income from Renewable Heat Incentive, payback period.
6. A calculation of the CO_2 savings that may be realised through the use of this technology (kgCO2/yr and %).

7. 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 free of shading
8. Quantification of the amount of roof area that could be used to install solar collectors

Please see Table 3 under Appendix B for details on the additional information required on solar thermal technology.

5.4.3 Details required in relation to wind energy applications.

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

1. 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, e.g. Carbon Trust Wind Energy Calculation Tool (http://www.carbontrust.co.uk/windpowerestimator)
2. Drawings showing the wind turbine location and height in relation to the surrounding structures and including the predominant wind directions
3. Wind turbine(s)'s specification such as number and type of turbine(s), rotor diameter, number of blades
4. An estimate of the peak power (rated) output, electricity output and percentage that the wind turbine/s modules may generate and calculated using the estimated wind resource and the wind turbine characteristics, i.e. power curve if available or a specific turbine swept area.
5. An estimate of the capital costs, potential electricity savings and income from Feed-in-Tariffs, payback period.
6. A calculation of the CO_2 savings that may be realised through the use of this technology (kgCO2/yr and %).

Please see Table 4 under Appendix B for details on the additional information required on wind technology.

5.4.4 Details required in relation to ground/water source heat pumps

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

1. Consideration of their appropriateness for the development
2. Clarification to 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
3. 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.
4. Heat pump's specification such as size and number of the heat pump(s), ground exchanger type (subsoil or boreholes), length of pipe required for installed capacity and number of vertical boreholes.

5. The estimation of the amount of heating/cooling that the GSHP may supply as well as the percentage of heating/cooling met by heat pump should be supported with the following information:
    i. For closed loop systems an indication of the land area available that would be required to install the required number of boreholes should be included in the energy assessment. Where possible, the ground conditions of the specific site should be taken into account for the calculations.
    ii. For open loop systems (including aquifer thermal storage systems) the flow rate of water that is available on-site should be included in the energy assessment and it should be used to estimate the amount of heating/cooling the system could provide.
6. Details of the Coefficient of Performance (COP) and Energy Efficiency Ratio (EER)
7. An indication of the seasonal COP and EER of the heat pumps is required
8. An estimate of the capital costs, potential fuel savings and income from Renewable Heat Incentive (if applicable), payback period.
9. A calculation of the CO_2 savings that may be realised through the use of this technology (kgCO2/yr and %).
10. 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.

Please see Table 5 under Appendix B for details on the additional information required on heat pump technology.

5.4.5 Details required in relation to air source heat pumps

Where the use of air source heat pumps is proposed the following information would also be required:

1. Consideration of their appropriateness for the development
2. Clarification 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, biomass boilers, solar thermal, etc. if they are also being proposed by the applicant)
3. 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
4. Heat pump's specification such as size and number of the heat pump(s)
5. Details of the Coefficient of Performance (COP) and Energy Efficiency ratio (EER) of the proposed heat pump under test conditions.
6. Evidences that the heat pump complies with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) product criteria note for the relevant ASHP technology (August 2009 guidance notes posted at http://www.eca.gov.uk/etl/criteria/)
7. Evidences that the heat pump complies with any other relevant issues as outlined in the Microgeneration Certification Scheme Heat Pump Product Certification Requirements document at http://www.microgenerationcertification.org/installers/product-manufacturer
8. An indication of the seasonal COP and EER of the heat pumps is required

9. A calculation of the CO_2 savings that may be realised through the use of this technology.

Please see Table 5 under Appendix B for details on the additional information required on heat pumps technology.

5.4.6 Details required in relation to biomass application[15]

In common with other types of combustion appliances, biomass boilers are potentially a source of air pollution. The pollutants associated with biomass combustion include particulate matter (PM10/PM2.5) and nitrogen oxides (NOx) emissions. These emissions can have an impact on local air quality and affect human health.

In response to current and projected breaches of national Air Quality Objectives for nitrogen dioxide (NO2) and particulate matter (PM10), the whole of the London Borough of Ealing has been declared an Air Quality Management Area. The borough also comprises a number of Smoke Control Areas designated under the Clean Air Acts. It is therefore essential that any new biomass boilers installed in the borough meet certain emission control requirements in order to protect local air quality. In order to approve a planning application associated with a biomass boiler, the information set out below must be supplied to the local authority.

In addition to any approval needed for planning purposes, biomass boilers of 16.12 kW or greater maximum heating capacity require approval by the Council of plans and specifications under section 4 of the Clean Air Act, 1993. This section of the Act also requires that the furnace (i.e. the boiler) is "so far as practicable capable of being operated continuously without emitting smoke when burning fuel of a type for which the furnace was designed". Where section 4 applies to the boiler concerned, the information supplied will also be used to determine an application for Clean Air Act purposes.

Please see Table 6 under Appendix B for details on the additional information required on biomass heating technology.

Boiler specification and design

1. Description of the proposed biomass boiler including make, model, manufacturer, thermal capacity (kw/MW), efficiency, maximum rate of fuel consumption (kg/hr or m3/hr)
2. Description of the boiler combustion system and how combustion will be optimised and controlled.
3. Description of the fuel feed system.
4. Details of the abatement equipment in place for controlling particulate matter emissions.
5. Details of how the boiler deals with variable heat loads and whether the boiler linked to an accumulation tank.
6. A copy of the test report issued in connection with the exemption of the appliance under the Clean Air Act 1993, section 21.

[15] See also Section 5 under Appendix B for details on the additional information required for biomass heating

7. Copies of any other certification/eco-labelling/accreditation test reports, e.g. Blue Angel.

Boiler operation and maintenance

1. Description of arrangements for cleaning and de-ashing the boiler and the disposal of ash.
2. A copy of the maintenance schedule for the boiler, abatement equipment and stack/flue. This should include the frequency of boiler inspection and servicing by a boiler engineer trained to service the make and model of boiler concerned.
3. Description of how any incidents of boiler or abatement system failure are identified and mitigated.

Boiler Stack and Emissions

The design of the boiler flue/stack greatly affects the way pollutants produced in the boiler disperse into the surrounding area. Where the area is heavily built up, or has existing air quality issues, dispersion becomes more complicated and a computer modelling technique known as dispersion modelling may be required. Your installer should be able to provide most of the details and make a calculation on stack height and design. When dispersion modelling is required you or your installer may need to engage a specialist consultant

1. A calculation of the required height of the boiler exhaust stack above ground .
2. Evidence to demonstrate that predicted emission concentrations associated with the calculated stack height do not have a significant impact on the air quality objectives for NO2 and PM10.
3. Stack internal diameter (m).
4. Maximum particulate matter and nitrogen oxides emission rates (mg/m3 or g/hr) to standard reference conditions (6% oxygen, 273K, 101.3kPa).
5. Exhaust gas efflux velocity (m/s).
6. Grid reference of boiler exhaust stack.
7. Consideration of any local features which could influence dispersion, such as overhanging trees, and an assessment of the likely impact of boiler emissions on them.

Fuel

Emissions from a biomass boiler depend on the type and quality of the fuel used. Reasonable guarantees are therefore needed that the fuel is compatible with the boiler, is of a high quality and that quality will be assured for a reasonable period of time. Your fuel supplier and installer should be able to provide this information.

1. Fuel specification including origin, type of wood (chips, pellet, briquettes), nitrogen, moisture, ash content (%).
2. Evidence that the proposed fuel complies with European or equivalent fuel quality standards such as CEN/TS 14961:2005 or ÖNORM.
3. Fuel quality control procedures to be adopted to guarantee constant fuel quality from your supplier.
4. Evidence to demonstrate that the biomass boiler combustion system is applicable to the fuel specification.
5. Identify where and how fuel will be stored on site (e.g. bunker or silo).

6. Arrangements for unloading the fuel from the delivery vehicle into the storage facility and what control measures will be in place to reduce particulate matter emissions to atmosphere.

Building Details

The height and distance of neighbouring buildings will determine their exposure to emissions from the biomass boiler, and therefore the height of the stack needed. Your architect should be able to provide this information.

1. Distance of adjacent buildings from boiler exhaust stack.
2. Height of adjacent buildings from boiler exhaust stack.
3. Dimensions of the building to which the boiler exhaust stack will be attached.
4. Distance from the boiler exhaust stack to the nearest fan assisted intakes and openable windows.

Plans

Please include the following with your application:-

1. A site plan showing the location of the boiler room, fuel storage area and the access and exit route for fuel delivery vehicles, and
2. A site plan showing the position of the boiler exhaust stack, fan assisted intake air vents and nearest openable windows.

5.4.7 Details required in relation to liquid biofuel applications

1. Details of the manufacturer's warranty for the use of the proposed liquid bio-fuel in the CHP unit chosen
2. Confirmation of the blend and standard of biofuel to be used (typically B100 BS EN 14214)
3. Details of potential supplier(s) of the bio-fuel to be used and written confirmation that they can supply the required quantities
4. Information relating to the maintenance regime of the CHP as a consequence of biofuel use
5. Review air quality implications of bio-fuel with borough air quality officers
6. 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
7. Details of how the fuel will be stored on site
8. 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.

Notes on guidance

Appendix A indicates how the results should be presented in the energy statement in order to be easy to read and compare. This does not restrict the applicants to provide their own format in the tables shown below.

Appendix B presents the type of information that should be provided in the energy statement.

Site plans should be used where possible, e.g. to indicate suitable roof areas for installing solar technologies or the location of a plant room. References should be used to explain where data has been obtained.

Appendix A

Example Templates

Annual CO2 emissions per sq.m

BER/ or DER		$kgCO_2/m^2/yr$
Notional		$kgCO_2/m^2/yr$
TER		$kgCO_2/m^2/yr$

1. Compliant Part L 2010 Base case

	Baseline*	
	Energy Demand	**CO_2 Emissions**
	kWh/yr	*$kgCO_2/yr$*
Heating		
Hot Water		
Auxiliary		
Lighting		
Cooking & Appliances/ Small Power (if applicable)		
Cooling (if applicable)		
Total heat & hot water		
Total electricity		
Total		

2. Demand Reduction (Be Lean)

Proposed Scheme with energy efficiency measures

	Proposed scheme**	
	Energy Demand	**CO_2 Emissions**
	kWh/yr	*$kgCO_2/yr$*
Heating		
Hot Water		
Auxiliary		
Lighting		
Cooking & Appliances/ Small Power (if applicable)		
Cooling (if applicable)		
Total heat & hot water		
Total electricity		
Total		
% Improvement		

Total energy and CO_2 savings after the implementation of the energy efficiency measures vs baseline scheme		
	Change	
	Energy Demand	CO_2 Emissions
	kWh/yr	*$kgCO_2/yr$*
Heating		
Hot Water		
Auxiliary		
Lighting		
Cooking & Appliances/ Small Power (if applicable)		
Cooling (if applicable)		
Total heat & hot water		
Total electricity		
Total savings		

3. Heating and Cooling Infrastructure including CHP (Be Clean)

Proposed Scheme with potential CHP, community / district heating scheme or centralised heating system		
	Proposed scheme***	
	Energy Demand	CO_2 Emissions
	kWh/yr	*$kgCO_2/yr$*
Heating		
Hot Water		
Auxiliary		
Lighting		
Cooking & Appliances/ Small Power (if applicable)		
Cooling (if applicable)		
Total heat & hot water		
Total electricity		
Total		
% Improvement		

Total energy and CO_2 savings after the implementation of the energy efficiency measures plus the potential CHP, community / district heating scheme or centralised heating system vs compliant Part L 2010 base case		
	Change	
	Energy Demand	CO_2 Emissions
	kWh/yr	*$kgCO_2/yr$*
Heating		
Hot Water		
Auxiliary		
Lighting		
Cooking & Appliances/ Small Power (if applicable)		

Total energy and CO_2 savings after the implementation of the energy efficiency measures plus the potential CHP, community / district heating scheme or centralised heating system vs compliant Part L 2010 base case		
	Change	
	Energy Demand	**CO_2 Emissions**
	kWh/yr	*$kgCO_2/yr$*
Cooling (if applicable)		
Total heat & hot water		
Total electricity		
Total savings		

4. Renewable energy (Be Green)

Proposed Scheme after the energy efficiency measures with recommended renewable/low carbon technology		
	Proposed scheme* **	
	Energy Demand	**CO_2 Emissions**
	kWh/yr	*$kgCO_2/yr$*
Heating		
Hot Water		
Auxiliary		
Lighting		
Cooking & Appliances/ Small Power (if applicable)		
Cooling (if applicable)		
Total heat & hot water		
Total electricity		
Total		
% improvement		

Total energy and CO_2 emission savings after the implementation of the energy efficiency measures plus the renewable/low carbon technology vs compliant Part L 2010 base case		
	Change	
	Energy Demand	**CO_2 Emissions**
	kWh/yr	*$kgCO_2/yr$*
Heating		
Hot Water		
Auxiliary		
Lighting		
Cooking & Appliances/ Small Power (if applicable)		
Cooling (if applicable)		
Total heat & hot water		
Total electricity		
Total		

Appendix B

Table 1. Combined Heat and Power Information Required

Power Plant type	
Name of unit	

Operational Load Factor				Daily Start Time	
Annual Operational Hours			Hrs	Daily Shutdown	
Machine capacity	(kWelec)			QI Rating	
	(kWheat)				
	□%				

Input			
Electricity generation	Electricity demand		MWh
	Electrical Power (Pel)		kw
	CHP Electricity generation		MWh
	supply from grid		MWh
	Elec Power Efficiency		%
Heat generation	Total heat demand		MWh
	Thermal Output (Pth)		kw
	CHP heat Generation		MWh
	Thermal efficiency		%
	Separate Heat generation		MWh
Cooling generation	Cooling Load		MWh
	Thermal Input to absorption chiller		kw
	Thermal Output from absorption chiller (rated)		kw
	Absorption chiller Cooling generation		MWh
	Seasonal Energy Efficiency Ratio of absorption chiller (SSEER)		
Energy input	Total CHP generation of electricity and heat		MWh
	Energy Input		kW
	Fuel use in total		MWh
	Overall annual efficiency		%
Associated emissions	**Primary Fuel**		Tonnes CO_2/year
	Electricity		
	No CHP		Tonnes CO_2/year
	CHP supply of part electrical load		Tonnes CO_2/year
	Heat		
	No CHP		Tonnes CO_2/year
	CHP supply of part head load		Tonnes CO_2/year
	Emission reduction due to CHP		Tonnes CO2/year
	Emissions without CCHP (assumes chiller/grid electricity)		
	Emissions from electric chiller operation (SSEER of 4.2)		Tonnes CO2/year
	Emissions from grid electicity (equivalent to electricity generated by CCHP)		Tonnes CO2/year

	Cummulative emissions from chiller / grid electricity		Tonnes CO2/year
	Overall Emissions savings from implementing CCHP		Tonnes CO2/year
	Cost of fuel for the CHP		
	Income from sale of electricity		
	Procurement of top up electricity		
	Reduction in grid supplied elec costs per year		
Economic	Reduction in cooling costs per year		
	Income from sale of heat		
	Procurement of top up heat.		
	Maintenance cost		
	Annual income		

Output		
CHP Heat output		MWh
CHP electricity output		MWh
Emission savings		Tonnes CO_2/year
Capital cost		£
Enhanced capital allowance contribution		£
Annual income		£
Simple Payback period		Years

Table 2. Solar Photovoltaic's Information Required

Photovoltaic Collectors (PV's)

PV Collector	
Collector Area	m2
Collector Type	-
Module Efficiency	%
Total System Efficiency	%

Energy

Potential Annual Energy Generated	kWh/yr
Potential Energy Generation per m2	kWh/m2
Installed Power	kWp
Percentage of Electricity Generated	%

Costs

Grant Available	% or £
Capital Cost Per kWp	£/kWp
Total Capital Cost	£
Potential Electricity Savings	£/year
Potential Income from Feed in Tariffs	£/yr
Simple Payback Period	yrs

Emissions

Potential Annual CO_2Savings	kgCO_2/yr
Potential Emissions Reduction	%

Table 3. Solar Hot Water System Information Required

Solar Thermal

Collector Type	-
Collector Area	m2
Collector System Efficiency	%

Energy

Potential Annual Energy Generated	kWh/yr
Potential Energy Generation per m2	kWh/m2
Percentage of DHW Generated	%

Costs

Grant Available	% or £
Capital Cost Per Square Metre	£/m2
Total Capital Cost	£
Potential Fuel Savings	£/yr
Simple Payback Period	yrs

Emissions

Potential Annual CO_2 Savings	$kgCO_2/yr$
Potential Emissions Reduction	%

Table 4. Wind Turbines Information Required

Wind Turbines

Number of Turbines	-
Turbine Type	-
Type of Wind Turbine	-
Rotor Diameter	m
Number of Blades	-

Energy

Peak Power (rated) Output	kW
Energy Output per Turbine	kWh/yr
Potential Annual Energy Generated	kWh/yr
Percentage of Electricity Generated	%

Costs

Grant Available	% or £
Total Cost per Turbine (installed)	£
Total Capital Cost	£
Potential Electricity Savings	£/yr
Potential Income from Feed in Tariffs	£/yr
Simple Payback Period	yrs

Emissions

Potential Annual CO_2 Savings	$kgCO_2/yr$
Potential Emissions Reduction	%

Table 5. Heat Pumps Information Required

Heat Pump Operational Data

Main Fuel Source of Heating	gas/elec
Size of heat pump	kW
Number of heat pumps	-
Heat pump COP (heating)	# (>1)
Heat pump COP (cooling)	# (>1)
Ground exchanger type	-
Length of pipe/unit installed capacity	m/kWh
Length of pipe required for installed capacity	m
No. of vertical boreholes required	-
Area required for subsoil ground exchanger	m

Operational Performance

Annual Heat Demand	kWh/yr
Annual Cooling Demand	kWh/yr
Maximum Heat Demand	kWh
Maximum Cooling Demand	kWh
Heat Generated by heat pump	kWh/yr
Cooling Generated by heat pump	kWh/yr
Gas Displaced by heat pump	kWh/yr
Electricity Displaced by heat pump	kWh/yr
Heat pump power input requirement (heating)	kWh/yr
Heat pump power input requirement (cooling)	kWh/yr
Heat Pump Run Hours	hr
Percentage of heat demand from heat pump	%
Percentage of cooling demand from heat pump	%

Costs

Grant Available	% or £
Annual Fuel Cost of Conventional Plant	£/yr
Annual Electricity cost of Heat Pump	£/yr
Heat Pump Budget unit cost	£/kwh
Heat Pump Maintenance Cost	£/yr
Capital Cost of Heat Pump	£
Income from Sale of Heat	£
Simple Payback Period	yrs

Heat Pump CO_2 Emissions

Natural Gas Emissions	$kgCO_2/yr$
Grid Electricity Emissions	$kgCO_2/yr$
Annual CO_2 Emissions	$kgCO_2/yr$

Conventional Plant CO_2 Emissions

Natural Gas Emissions	$kgCO_2/yr$
Grid Electricity Emissions	$kgCO_2/yr$
Annual CO_2 Emissions	$kgCO_2/yr$

Annual CO_2 Emissions Reduction

Annual CO_2 Reduction	$kgCO_2/yr$
% Emissions Reduction	%

Table 6. Biomass Information Required

Biomass boiler

Biomass boiler size	kW
Biomass boiler efficiency	%
Max Turn Down (% of Peak Output)	%
Potential Annual Energy Generated	kWh/yr
Biomass Annual Fuel Consumption	kWh/yr
Percentage of Heat Load Generated	%

Biomass Fuel Consumption

Biomass Fuel Type	-
Biomass Calorific Value/ Tonne	GJ/tonne
Biomass Calorific Value/ kg	kWh/kg
Annual Biomass Fuel Requirement	kg

Storage & Delivery Requirements

Distance to Biomass Fuel Source	km
Storage Size of Delivery Truck	m3
Biomass Storage Density	kg/m3
Tonnes of Biomass per Delivery	tonnes
Annual Delivery Requirement	-
Biomass Storage Requirement	m3

Costs

Grant Available	% or £
Biomass Fuel Cost / tonne	£/ton
Biomass Fuel Cost / kWh	£/kWh
Replacement Boiler Size	kW
Capital Cost of Biomass Boiler	£
Annual Fuel Cost of Biomass	£/annum
Capital Cost of Gas Boiler	£
Annual Fuel Cost of Conventional Boiler	£/annum
Simple Payback Period	yrs

Emissions

CO2 Produced from Transport	$kgCO_2/yr$
CO2 Emissions from Gas Boiler	$kgCO_2/yr$
CO2 Emissions from Biomass Boiler	$kgCO_2/yr$
Net Potential Annual CO_2 Saving	$kgCO_2/yr$
Potential Emissions Reduction	%

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