

MAYOR OF LONDON

London Plan Guidance

Air Quality Neutral

February 2023

Copyright

Greater London Authority

February 2023

Published by:

Greater London Authority

City Hall

Kamal Chunchie Way

London

E16 1ZE

www.london.gov.uk

Enquiries 020 7983 4000

Email planningsupport@london.gov.uk

Other formats

If you require this document in a more accessible format, please get in touch via our [online form](#) and tell us which format you need.

Table of contents

1	About this document	2
1.1	What is 'Air Quality Neutral'?.....	2
2	Applying Air Quality Neutral	3
2.1	Air Quality Neutral Assessments for planning applications	3
2.2	Excluded development.....	3
2.3	Minor developments.....	4
2.4	Phased developments.....	5
2.5	Material and non-material amendments	5
2.6	Securing compliance for building emissions	6
2.7	Securing compliance for transport emissions	6
3	Building Emissions Benchmark (BEB)	7
3.1	Calculating the BEB	7
3.2	Calculating the predicted building emissions	10
3.3	Generators.....	12
3.4	Connecting to existing heat networks	13
4	Transport Emissions Benchmark (TEB).....	14
4.1	Calculating the TEB	14
4.2	Calculating the predicted trip rate.....	16
5	Mitigation and offsetting	17
5.1	Mitigation measures.....	17
5.2	Offsetting payments	17
5.3	Calculation of transport emissions for offsetting purposes	19
6	Reporting.....	20
Appendix 1	Example Air Quality Neutral Calculations	21
A1.1	Example 1	21
A1.2	Example 2.....	26
A1.3	Example 3.....	28
A1.4	Example 4.....	30
Appendix 2	Application to a Phased Energy Strategy	32

London Plan Policy

[Policy SI1 Improving Air Quality Part B\(2\)\(a\) and Part E](#)

Plan making

N/A

Planning Application type and how the London Plan Guidance will be applied

All [development](#), unless specifically excluded (see section 2.2) is required to submit an Air Quality Neutral Assessment (AQN Assessment) demonstrating how the Air Quality Neutral benchmarks in this guidance will be met.

There is a simplified assessment for [minor development](#) (see section 2.3).

Who is it for

Planning authorities, architects, transport planners and engineers, energy consultants and engineers, and applicants. For use in designing and specifying building and transport in design and in quantifying and assessing air quality performance against relevant Air Quality Neutral benchmarks.

1 About this document

1.1 What is 'Air Quality Neutral'?

- 1.1.1 An Air Quality Neutral development is one that meets, or improves upon, the Air Quality Neutral benchmarks set out in this document. These benchmarks set out the maximum allowable emissions of NO_x and particulate matter based on the size and use class of the proposed development. These benchmarks are based on research and evidence carried out by building and transport consultants and are designed to prevent the degradation of air quality from the combined emissions of individual developments.

2 Applying Air Quality Neutral

2.1 Air Quality Neutral Assessments for planning applications

- 2.1.1 There are two sets of benchmarks, which cover the two main sources of air pollution from new developments:
- Building Emissions Benchmark (BEB) – emissions from equipment used to supply heat and energy to the buildings
 - Transport Emissions Benchmark (TEB) – emissions from private vehicles travelling to and from the development.
- 2.1.2 A development must meet both benchmarks separately in order to be Air Quality Neutral. If one or both benchmarks are not met, appropriate mitigation or offsetting will be required (see section 5). As the benchmarks are based on evidence and are designed to be challenging but achievable, mitigation or offsetting provisions should be the exception.
- 2.1.3 Calculations against the benchmarks should inform the design process. However, the final AQN Assessment itself can only be prepared once the energy and transport strategies for a development are suitably finalised or, where these strategies are not part of the application, development details are finalised for planning submission.

2.2 Excluded development

- 2.2.1 Developments, including major developments, that do not include additional emissions sources are assumed to be Air Quality Neutral and to meet the Air Quality Neutral benchmarks. As such, there is no need to do an AQN Assessment. This would include, for example, developments that have no additional motor vehicle parking, do not lead to an increase in motor vehicle movements¹, and do not include new combustion plant such as gas-fired boilers. It is good practice to advise the local planning authority that the development meets this criterion when submitting a planning application, for example in a cover letter or the planning statement.
- 2.2.2 Developments that are subject to Environmental Permits, issued either by the Environment Agency or the Borough Council, are subject to the Air Quality Neutral benchmarks for all emission sources within the development not controlled by the Environmental Permit.

¹ Taxi, delivery and servicing vehicle trips, as well as heavy vehicle trips produced by the operation of an industrial or commercial premises are not covered by Air Quality Neutral. Please see paragraph 4.1.5 for further information.

- 2.2.3 Where a Medium Combustion Plant (MCP) or Specified Generator (SG) is proposed as part of the energy strategy for a development and is subject to emissions limits through an Environmental Permit, the developer must nevertheless set out how the development as a whole, including the permitted appliance, complies with the BEB.
- 2.2.4 In cases where the permit Emissions Limits imply the potential for annual emissions higher than the BEB, achieving compliance with the BEB may require: the use of low or zero-emission technology to reduce the total emissions from the energy centre(s); limiting the hours of use of the appliance; installing an appliance that emits less than the Emission Limit stated in the standard rules permit; or other techniques to reduce emissions.

2.3 Minor developments

- 2.3.1 All developments in London are expected to meet the Air Quality Neutral benchmarks. However, for minor developments including:
- dwellings, where the number of dwellings to be constructed is between one and nine inclusive
 - a site area of less than 0.5 hectares for the construction of dwellings where the number of dwellings to be constructed is not given in the application
 - a development where the floor space to be built is less than 1,000 m² floor area or where the site area is less than one hectare (non-dwellings).

a full air quality assessment (which would normally incorporate the AQN Assessment) will likely not be required (unless required by the local planning authority as set out in 2.3.3 below). A simplified procedure for these developments is set out in sections 3.1.1, 3.1.2, 4.1.1 and 4.1.2.

- 2.3.2 Details of emission sources included in the development proposals should be set out in the planning application and may be secured by planning condition or legal agreement. For example, minimum emissions standards for combustion plant or maximum permitted car parking spaces.
- 2.3.3 In certain cases, such as developments in an Air Quality Focus Area, the local planning authority may require a full air quality assessment for a minor development due to the nature or location of the proposed scheme. In these cases, the Full procedure for the Building Emissions Benchmark (BEB) and the Full procedure for the Transport Emissions Benchmark (TEB) should be used in the AQN Assessment.

2.4 Phased developments

- 2.4.1 Where developments are phased, the entire development should be Air Quality Neutral; and should be Air Quality Neutral at the completion of each phase. This will normally require assessment against the benchmarks at a number of separate points, e.g. at outline application stage to demonstrate that the completed development should be Air Quality Neutral, with further assessments carried out as part of the application for each phase based on detailed proposals, and/or interim/final energy and transport assessments. Refer to Appendix 2 for further guidance.
- 2.4.2 If new car parking is brought forward in phases, the development should be tested against the TEB at the outline application stage, and again as detailed plans for each phase are brought forward.
- 2.4.3 If car parking is built as part of a single phase of the development, but intended to serve multiple phases, the applicant should show either of the following:
- parking spaces will only be released for use as the phase they are intended to serve is completed
 - the phase in which the parking is delivered meets the TEB when considered in isolation.

2.5 Material and non-material amendments

- 2.5.1 Changes to the design, energy or transport strategy after planning permission has been granted may affect whether a development is Air Quality Neutral. A reassessment of compliance with this guidance will normally be required for amendments to a planning consent that affect any of the following:
- energy strategy
 - the proposed type or number of power and/or heating appliances
 - transport strategy and/or travel plan
 - number of parking spaces
 - parking management plan
 - number of residential units
 - floorspace assigned to non-residential use classes.

- 2.5.2 The reassessment should be proportionate and limited to the extent of the amendments. For example, a change to the number of car parking spaces would not need a reassessment of building emissions. A change that would unambiguously reduce emissions, such as replacing planned domestic boilers with heat pumps, or removing car parking could be allowed on that basis without reassessment at the discretion of the local planning authority.

2.6 Securing compliance for building emissions

- 2.6.1 Details of the specific appliance that will be installed in the completed development are not always known at the planning application stage. Even when a specific appliance is assumed at planning application stage, for many reasons, this may be different to the appliance that is installed in the completed development. It is therefore strongly advised that a condition requiring approval of the appliance details is used to ensure that the installed system is as good as, or better than, that used in the AQN Assessment. For larger and more complex systems, abatement equipment may be needed to minimise emissions. Where abatement is required, the installation, use and maintenance of the abatement equipment should similarly be required by condition.

2.7 Securing compliance for transport emissions

- 2.7.1 For most developments, the key driver of transport emissions is the provision of car parking spaces. Therefore, a condition or legal agreement restricting car parking spaces to a specified maximum (not exceeding the amount assumed for the Air Quality Neutral calculation) should be applied.
- 2.7.2 Where the development proposal requires specific local measures to reduce trip generation or trip length, these should be secured by condition or legal agreement.

3 Building Emissions Benchmark (BEB)

3.1 Calculating the BEB

Simplified procedure for the Building Emissions Benchmark (BEB)

- 3.1.1 Where minor developments (as set out within 2.3.1) include new heating systems, they can be assumed to meet the BEB in any of the following instances:
- the new heating system is a heat pump or other zero-emission heat source
 - the new heating system includes one or more individual gas boilers with NO_x emissions rated at less than 40 mg/kWh
 - the development is connecting to an existing heat network.
- 3.1.2 Where a development meets the criteria above, the rest of section 3 does not apply. If the criteria above is not met, a full AQN Assessment against the BEB is required, as per the procedure below.

Full procedure for the Building Emissions Benchmark (BEB)

- 3.1.3 The BEB is defined in grams (g) of nitrogen oxides (NO_x) emitted per square metre (m²) of floorspace over a year (gNO_x/m²/annum). The floorspace is defined as the gross internal area (GIA). The benchmark NO_x emission rates are defined for different land uses and are dependent on the characteristics of the energy strategy adopted for the development. These are based on achievable emission rates for the type of technology used. The benchmark NO_x emission rates are defined in Table 3.1.
- 3.1.4 Most non-combustion heat sources such as electric panel heaters and heat pumps (including air source and ground source heat pumps) are assumed to have zero heat-related NO_x emissions. However, for the avoidance of doubt, checks should be made with the manufacturer or an air quality consultant when non-standard or innovative technologies are used.
- 3.1.5 Solid and liquid biomass/non-biomass fired appliances also emit fine particulate matter in addition to NO_x. The benchmark emission rate for particulate matter is zero. Any development that uses solid or liquid fuels for primary or secondary heating will therefore not be Air Quality Neutral and will require mitigation or offsetting (see section 5).

Table 3.1 BEB NO_x emission rates (gNO_x/m²/annum)

Land use ²	Individual gas boilers	Gas boiler network	CHP + gas boiler network	Heat pumps + gas boiler network
Residential (including student accommodation and large-scale purpose-built shared living development)	3.5	5.7	7.8	5.7
Retail	0.53	0.97	4.31	0.97
Restaurants and bars	1.76	3.23	14.34	3.23
Offices	1.43	2.62	11.68	2.62
Industrial	1.07	1.95	8.73	1.95
Storage and distribution	0.55	1.01	4.50	1.01
Hotels	9.47	15.42	38.16	15.42
Care homes and hospitals	9.15	14.90	36.86	14.90

² Where the use class/land use type is not specified in a development proposal or is not listed in Table 3.1 it is up to the discretion of the local planning authority to decide and use the most relevant land use from the table (given the information submitted at the planning application stage). Where use class E has been specified without further detail, the emission rates for retail should be used as the default worst-case scenario.

Land use ²	Individual gas boilers	Gas boiler network	CHP + gas boiler network	Heat pumps + gas boiler network
Schools, nurseries, doctors' surgeries, other non-residential institutions	0.90	1.66	7.39	1.66
Assembly and leisure	2.62	4.84	21.53	4.84

3.1.6 The GIA for each land use is multiplied by the corresponding benchmark NO_x emission rate in Table 3.1 to calculate the benchmark NO_x emissions for each land use in the development proposal. These are then added together to calculate the BEB for the development, as shown in Table 3.2. Further example calculations are provided in Appendix 1.

Table 3.2 Example BEB calculation

Land Use	GIA (m ²)	Benchmark NO _x emission rate (gNO _x /m ² /year)	Total benchmark emissions (gNO _x /year)
Example land use 1	A	B	A x B = C
Example land use 2	D	E	D x E = F
BEB for the development			C + F

3.1.7 The GIA for each land use in the calculation should match the submitted planning documents, including the planning application form. Any deviation should be clearly indicated and justified.

3.2 Calculating the predicted building emissions

- 3.2.1 To calculate the total predicted building emissions, the typical energy use for each different combustion source proposed within the development, and an emission rate for each combustion source, will need to be known. The predicted annual energy use for each emission source can be found in the energy assessment³ for the development proposal (in a table similar to Table 3.3 below).
- 3.2.2 Where there is no energy assessment available, information about the proposed emission sources, their predicted annual energy use and emission rates should be provided elsewhere in the planning application documents or appended to the AQN Assessment.
- 3.2.3 The NO_x emissions rate for grid electricity use reported in Table 3.3 should be assumed to be zero. This is because any NO_x emissions associated with electricity generation at power stations will be dealt with in local permissions for those facilities.

Table 3.3 Energy-use reporting template for predicted building emissions

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

³ Further information can be found in the [GLA's Energy Assessment Guidance](#).

3.2.4 The emission rate for each emission source will be included in the manufacturer’s specification for the specific appliance. Where combined heat and power (CHP) is used, this may include selective catalytic reduction (SCR) or other technology to manage emissions. The size (output) of the CHP is the main factor that determines whether SCR is used, but there is no absolute cut-off point.

3.2.5 The predicted emissions for each source are:

Energy use for each source x emission rate of each source

3.2.6 These are then added together to give total predicted building emissions for the development (see Table 3.4). The development is considered Air Quality Neutral in terms of building emissions if the total predicted building emissions are less than the BEB.

Table 3.4 Example total predicted building emissions calculation

	Energy use (MWh/year)	NO _x emission rate (mg/kWh)	Total predicted NO _x building emissions (mg/annum)
Emission source 1	A	B	A x B = C
Emission source 2	D	E	D x E = F
Total predicted building emissions for the development			C + F

3.2.7 Where it has not been possible to identify a specific unit that will be installed, the generic emission rates in Table 3.5 can be used in the assessment on the condition that the final units will not produce emissions that exceed those in the table.

Table 3.5 Generic emission rates for combustion technologies

Technology type	NO _x emission rate
Gas boiler	40 mg/kWh
Gas engine with SCR	25 mg/Nm ³ ⁴
Heat pump	0

3.3 Generators

- 3.3.1 Backup plants installed for emergency and life safety power supply, such as diesel generators, may be excluded from the calculation of predicted building emissions. Normally, it is expected that the use of these generators for anything other than an emergency and operational testing (less than 50 hours per year) would be prevented by planning conditions. The NO_x and particulate matter emissions of generators used for purposes other than an emergency, such as selling power into the national grid, must be included in Air Quality Neutral calculations. Where appropriate, local authorities could seek a more restrictive condition if that would be consistent with the safe operation of the generator.
- 3.3.2 It should be noted that some generators are likely to be affected by MCP or SG limits and must comply with them. It is expected that smaller generators would also comply with these emissions limits.

Generators for temporary applications

- 3.3.3 Emissions from generators that form part of planning applications for temporary structures should be included in the calculation of building emissions, as per the provisions in paragraph 3.3.1.
- 3.3.4 Emissions from generators which form part of planning applications for temporary events,⁵ where generators are required for the event operation, do not need to be included.⁶

⁴ Emission standard quoted at reference conditions 273K, 101.3kPa, 5 per cent O₂, dry gas.

⁵ Gov.uk, [Temporary Events Notice \(England and Wales\)](#)

⁶ Legislation.gov.uk, [The Town and Country Planning \(General Permitted Development\) \(England\) Order 2015](#)

3.4 Connecting to existing heat networks

- 3.4.1 New developments in [Heat Network Priority Areas](#) are expected to prioritise connection to existing district heat networks or be future-proofed for connection to a proposed network. Connection to a district heat network does not mean the development is automatically considered to be Air Quality Neutral and an assessment will still need to be carried out. The assessment needed will depend on the type of heat network. Where the heat is genuinely from an existing source that would otherwise be wasted, the emission rate is zero.
- 3.4.2 However, if a heat network's capacity is being expanded to serve a new development, that additional capacity must come from low- and zero-carbon heat sources and will still need to be calculated in the normal way.
- 3.4.3 As a minimum, it is expected that the introduction of additional sources to an existing heat network will support the implementation of the network's decarbonisation strategy.
- 3.4.4 Where the heat is from a purpose-built communal heat network, the situation is more complex. In either of the following scenarios, any additional emissions from the heat network should be accounted for in the AQN Assessment:
- the development proposal results in the heat network operating at higher loads or longer hours
 - a new plant is installed in the energy centre(s) to meet the increased demand of the development proposal.
- 3.4.5 The emission rate and energy use used should be based on the actual equipment installed in the energy centre. Technical details should be obtained from the energy and sustainability consultant, energy centre operator or other relevant specialist.
- 3.4.6 Where a new energy centre is being built to supply a communal heat network, the full emissions from the energy centre attributable to the development should be included in the building emissions calculation.

4 Transport Emissions Benchmark (TEB)

4.1 Calculating the TEB

Simplified procedure for the Transport Emissions Benchmark (TEB)

- 4.1.1 Where minor developments (as set out in 2.3.1) include new parking, they can be assumed to meet the TEB if the maximum parking standards set out in policies [T6](#) and [T6.1](#) to [T6.5 of the London Plan](#) are not exceeded. For land uses where maximum parking standards are not defined, a full calculation against the benchmarks should be carried out.
- 4.1.2 Where a development meets the criteria above, the rest of section 4 does not apply. If the criteria above is not met, a full AQN Assessment is required against the TEB, as per the procedure below. Where major developments meet the definition of 'car-free',⁷ they can be assumed to meet the TEB and the rest of section 4 does not apply. This assumption does not exempt a development from considering building emissions (see section 3).

Full procedure for the Transport Emissions Benchmark (TEB)

- 4.1.3 The TEB is defined as the predicted number of single trips per m² of floorspace (GIA) over a year (trips/m²/year) for non-residential use, or the anticipated number of single trips per dwelling (trips/dwelling/year) for residential use. An outward and return journey to and from a location therefore counts as two trips. Trip rate benchmarks are based on data from the Trip Rate Information Computer System (TRICS)⁸ and are defined for different land uses and different areas of London. These are set out in Table 4.1.
- 4.1.4 The TEB only estimates car or light van trips undertaken directly by the development occupiers (residents, businesses etc and their staff / customers). The TEB does not include 'operational' trips generated by the developments. Deliveries and servicing, taxis or heavy vehicle movements from non-occupiers' assessment of these trips, for example, should be captured in the wider air quality impact assessment where one is required and should therefore be excluded from TEB calculations. If intended commercial uses are specified in a development proposal that falls under use class E, the corresponding benchmark from Table 4.1 should be used for this assessment.

⁷ Developments that are defined as 'car-free' may include provision for disabled persons parking. The standards for disabled persons parking are outlined in the London Plan parking policies (T6 and T6.1 to T6.5) and supporting text.

⁸ [TRICS](#) provides information based on observed trip rates from developments, and these will be monitored and updated where necessary.

Table 4.1 Benchmark trip rates

Land use ⁹	Annual trips per	Central Activities Zone (CAZ)	Inner London (excluding CAZ)	Outer London
Residential (including student accommodation and large-scale purpose-built shared living development)	dwelling	68	114	447
Offices/light industrial	m ² (GIA)	2	1	16
Retail (superstore)	m ² (GIA)	39	73	216
Retail (convenience)	m ² (GIA)	18	139	274
Restaurants/café	m ² (GIA)	64	137	170
Drinking establishments	m ² (GIA)	0.8	8	N/A
Hot food takeaway	m ² (GIA)	0	32.4	590
Industrial	m ² (GIA)	0	5.6	6.5
Storage and distribution	m ² (GIA)	0	5.5	6.5
Hotels	m ² (GIA)	1.0	1.4	6.9
Care homes and hospitals	m ² (GIA)	0	1.1	19.5
Schools, nurseries, doctors' surgeries, other non-residential institutions	m ² (GIA)	0.1	30.3	44.4
Assembly and leisure	m ² (GIA)	3.6	10.5	47.2

⁹ Where the use class/land use type is not specified in a development proposal or not listed in Table 4.1, it is up to the discretion of the local planning authority to decide and use the most relevant land use from the table (given the information submitted at the planning-application stage). Where use class E has been specified without further detail, the benchmark for office/light industrial should be used as the default worst-case scenario.

4.1.5 Where parts of the development will have no dedicated parking – for example, a residents’ gym that is not accessible to the public – these should be excluded from the calculation of the TEB. The number of dwellings (residential) or GIA (non-residential) for each land use is multiplied by the benchmark trip rate to calculate the benchmark trip rates for each land use. These are then added together to calculate the TEB for the development as shown in Table 4.2. Further example calculations are provided in Appendix 1.

Table 4.2 Example TEB calculation

Land use	Annual trips per	Trip rate benchmark	Total benchmark trip rate (trips/year)
Example residential land use 1	‘A’ dwellings	B	$A \times B = C$
Example non-residential land use 2	‘D’ m ²	E	$D \times E = F$
TEB for the development			C + F

4.2 Calculating the predicted trip rate

4.2.1 A trip rate is usually calculated as part of the transport assessment for the development. This figure should be used in the AQN Assessment. Trip rates from TRICS can be used if they are also used in the transport assessment and multiplied to give an annual, rather than daily, number of predicted generated trips. In some cases, the transport assessment will only include peak hour trips. In these cases, either of the following actions should be taken:

- include additional data setting out the full number of predicted trips based on the same modelling as the transport assessment (as an appendix to the air quality assessment or transport assessment)
- show how daily and annual trip rates have been calculated from the peak hour trips in the transport assessment; this should be done in accordance with [best transport assessment practice](#), as set out by Transport for London.

4.2.2 A breakdown of the predicted trip rate between different land uses is not required, but it may be helpful to do this if the TEB is exceeded. If the total trip rate is less than or equal to the TEB, the development is Air Quality Neutral in terms of transport emissions.

5 Mitigation and offsetting

5.1 Mitigation measures

- 5.1.1 The Air Quality Neutral benchmarks have been calculated to be achievable and designed to be consistent with the energy and transport policies of the London Plan.
- 5.1.2 If the assessment shows that the development fails to meet one or both benchmarks, details of the development should be amended to meet the benchmarks as a first step. This could include changes to the energy or transport strategies, or changes to the overall design of the development.
- 5.1.3 If development is still not able to meet the benchmarks, the next step is to seek agreement with the local planning authority to secure on- or off-site mitigation measures (with on-site measures preferred in accordance with [Part E of Policy SI 1](#)). Mitigation measures should exceed the minimum requirements in the London Plan policies. An example might be exceeding minimum requirements for cycle parking or phased removal of car parking.
- 5.1.4 Mitigation measures should be agreed following these principles:
- Measures should be demonstrably effective and show how they will reduce local emissions or concentrations.
 - Measures should relate to the type of excess emissions – for example, measures to reduce building emissions should not be used to compensate for excess transport emissions. Similarly, local NO_x reductions should not be used to compensate for excess particulate matter emissions.
 - The measures should be genuinely additional to all the measures already accounted for in the air quality assessment.
 - The measures should be in place by the time the development is occupied.
 - Implementation of the measures must be robustly secured via planning condition or legal agreement.
- 5.1.5 Measures may be suggested by the local planning authority or by the applicant, but the local planning authority must determine whether proposed measures are appropriate and adequate to meet the London Plan policy.

5.2 Offsetting payments

- 5.2.1 If it is not possible to identify or agree appropriate and adequate mitigation measures, it may be possible, at the discretion of the local planning authority, to agree an offsetting payment instead. The offsetting payment is calculated by multiplying the excess emissions above the benchmarks

(tonnes/annum) by the damage costs (£/tonne) over a 30-year period, with a 2 per cent annual uplift, as set out in Table 5.1. An example offsetting payment calculation is also provided in section A1.1 in Appendix 1. The damage cost per tonne of excess emissions should use the most up-to-date version of the [Defra-published damage costs for air pollution](#). Most recently this sets both generic damage costs and specific damage costs for different emission sources. Where these differ, the highest-category damage cost applicable to any part of the development should be used.

Table 5.1 Example offsetting payment calculation

	Benchmark (tonnes/ annum)	Total predicted emissions (tonnes/ annum)	Excess emissions ¹⁰ (tonnes/ annum)	Damage cost (£/tonnes)	Annual offsetting amount (£)
Building NO _x emissions	A ¹¹	B	C = (B-A)	D	E = (C x D)
Building PM _{2.5} emissions	F	G	H = (G-F)	I	J = (H x I)
Transport NO _x emissions	K	L	M = (L-K)	N	O = (M x N)
Transport PM _{2.5} emissions	P	Q	R = (Q-P)	S	T = (R x S)

$$\text{Total}^{12} = \{(E + J + O + T) \times [(1+0.02)^{30}-1]\}/0.02$$

5.2.2 The details of an offsetting payment and when it should be made are subject to agreement between the local planning authority and the developer.

¹⁰ If the figure is less than 0, it should be entered as zero in the table. It is not permitted to use good performance against one benchmark to offset exceedances of another benchmark.

¹¹ For the purposes of offsetting, any NO_x emissions from solid/liquid fuels will be assumed to have a benchmark of 0

¹² The simplified formula is $\{(E + J + O + T) \times 40.568079205$

However, it would normally be collected via section 106 agreements, expected to be paid in full prior to the occupation of the development and will contribute towards measures to reduce local emissions or concentrations

5.3 Calculation of transport emissions for offsetting purposes

5.3.1 For simplicity, the transport benchmarks only consider the trip rate generated by the development. However, for offsetting payments, an excess emission rate will need to be calculated. To calculate the excess emissions above the benchmark, both the benchmark and the predicted trip rates will need to be multiplied by a trip length and an emission factor. These are provided in Table 5.2 and Table 5.3. The trip lengths are only provided for a limited number of uses. Local planning authorities will advise which to use for other uses – but in general, this should be the higher of the possible options. An example offsetting calculation is provided in Appendix 1.

Table 5.2 Average distance (km) travelled by car per trip

Land use	CAZ	Inner London	Outer London
Residential	4.2	3.4	11.4
Office	3.0	7.2	10.8
Retail	9.2	5.5	5.4

Table 5.3 Emission factors per vehicle-km (g/veh-km)

Pollutant	CAZ	Inner London	Outer London
NO _x	0.48	0.39	0.35
PM _{2.5}	0.036	0.032	0.028

6 Reporting

- 6.1.1 For minor developments (as set out in 2.3.1), use the simplified procedure as set out in paragraphs 3.1.1 and 4.1.1 and include relevant details in a cover letter or in other planning application documents.
- 6.1.2 For most major developments, the AQN Assessment will form part of the wider air quality assessment. For clarity, the AQN Assessment should be set out in its own chapter or section of the air quality assessment. The minimum requirements for reporting are:
- tables showing the detailed calculation of the BEB and the TEB (sections 3 and 4)
 - tables showing the detailed calculation of the predicted building and transport emissions for the development (sections 3.2 and 4.2)
 - a final calculation and statement to demonstrate whether the development as planned is or is not Air Quality Neutral
 - if the development does not meet the Air Quality Neutral benchmarks, the mitigation measures to be secured to ensure the development can be considered Air Quality Neutral
 - supporting evidence or references to supporting evidence.
- 6.1.3 For phased developments, separate tables should be prepared for the development as a whole and for any phases where a full detailed design is included in the application.
- 6.1.4 Supporting evidence – such as GIAs for each land use, number of parking spaces and proposed heating technology – will be taken from other assessments and documents accompanying the application. Therefore, the source of any relevant information should be clearly referenced where appropriate.
- 6.1.5 The emission factor or trip rate used should be clearly stated. If a specific emission factor for building emissions is used, evidence should be included in or appended to the report. For instance, if a specific make and model of low NO_x boiler is assumed, then the manufacturer's data sheet should be included.

Appendix 1 Example Air Quality Neutral Calculations

A1.1 Example 1

A1.1.1 A mixed-use residential development in inner London for up to 29,022 m² of development, comprising:

- 324 residential dwellings up to 28,000 m²
- retail, up to 120 m²
- office, up to 110 m²
- a doctors' surgery, up to 660 m²
- a community hall, up to 130 m²
- an energy centre comprising three gas-fired boilers.

Building emissions

A1.1.2 Total NO_x emissions from the development were calculated from the generic emission rate for gas boilers of 40 mg/kWh, and a total annual energy usage of 2,100,000 kWh as provided by the energy and sustainability consultant.

$$40 \text{ mg/kWh} \times 2,100,000 \text{ kWh} = 84 \text{ kg}$$

A1.1.3 The total benchmarked building NO_x emission is calculated from the land use categories and the emissions benchmarks for a gas boiler network, as shown in Table A1.1.

Table A1.1 Calculation of BEB (Example 1)

Land use	GIA (m ²)	Benchmark emission rate (g/m ² /annum)	Total benchmark emissions (kg)
Residential	28,000	5.7	159.6
Retail	120	0.97	0.12
Office	110	2.62	0.29
Doctors' surgery	660	1.66	1.10

Land use	GIA (m ²)	Benchmark emission rate (g/m ² /annum)	Total benchmark emissions (kg)
Community hall	130	4.84	0.63
Total			161.7

A1.1.4 The total building emissions (84 kg) are less than the total BEB (161.7 kg). The development is thus Air Quality Neutral in terms of building emissions.

Transport emissions

A1.1.5 The transport assessment for the development predicted that the development will generate a total of 140,590 car trips per annum, comprising trips relating to each of the following land uses:

- residential: 324 dwellings, up to 75,624 m²
- retail: 120 m²
- office: 110 m²
- doctors' surgery: 660 m²
- community hall: 130 m²

A1.1.6 The total benchmark trip rates have been calculated as shown in Table A1.2.

Table A1.2 Calculation of TEB (Example 1)

Land use	GIA (m ²) / No. dwellings	Benchmark trip rate	Total benchmark trip rate
Residential	324 dwellings	114	36,936
Retail	120	139	16,680
Office	110	1	110
Doctors' surgery	660	30.3	19,998

Land use	GIA (m ²) / No. dwellings	Benchmark trip rate	Total benchmark trip rate
Community hall	130	10.5	1,365
Total (TEB)			75,089

A1.1.7 The total development trip rate is greater than the TEB. The development is thus not Air Quality Neutral in terms of transport emissions.

Entire development

A1.1.8 While the development was Air Quality Neutral in terms of building emissions, the total trip rate exceeded the TEB. Thus, mitigation of transport-related emissions would be required should no changes to the proposal be made.

Offsetting

A1.1.9 In the event that suitable mitigation cannot be agreed between the applicant and the local planning authority, an offsetting payment would need to be agreed to mitigate the excess transport emissions.

A1.1.10 In order to calculate the relevant offsetting payment, the TEB and total transport trip rates need to be converted into NO_x and PM_{2.5} emissions (see Table A1.3 and Table A1.4).

Table A1.3 Calculation of benchmark emissions (Example 1)

Land use	Benchmark trip rate	Average distance per trip (km)	Emissions (g/veh-km)		Total emissions (kg)	
			NO _x	PM _{2.5}	NO _x	PM _{2.5}
Residential	36,936	3.4	0.39	0.032	49.0	4.0
Retail	16,680	5.5			35.8	2.9
Office	110	7.2			0.31	0.03

Land use	Benchmark trip rate	Average distance per trip (km)	Emissions (g/veh-km)		Total emissions (kg)	
			NO _x	PM _{2.5}	NO _x	PM _{2.5}
Doctors' surgery	19,998	7.2			56.2	4.6
Community hall	1,365	5.5			2.9	0.24
Total					144.2	11.8

Table A1.4 Calculation of development emissions (Example 1)

Land use	Development trip rate	Average distance per trip (km)	Emissions (g/veh-km)		Total emissions (kg)	
			NO _x	PM _{2.5}	NO _x	PM _{2.5}
Residential	75,624	3.4	0.39	0.032	100.3	8.3
Retail	21,568	5.5			46.3	3.8
Office	1,250	7.2			3.5	0.3
Doctors' surgery	38,698	7.2			108.7	8.9
Community hall	3,450	5.5			7.4	0.6
Total					266.2	21.9

A1.1.11 The excess emissions are then multiplied by the relevant damage costs and multiplied over 30 years, with a 2 per cent annual uplift, to give the total offsetting payment of £426,716.96 (see Table A1.5).

Table A1.5 Calculation of offsetting payment (Example 1)

	Benchmark (tonnes/ annum)	Total predicted emissions (tonnes/ annum)	Excess emissions (tonnes/ annum)	Damage cost (£/tonne)	Annual offsetting amount (£)
Building NO _x emissions	0.162	0.084	0	N/A	N/A
Building PM _{2.5} emissions	0	0	0	N/A	N/A
Transport NO _x emissions	0.144	0.266	0.122	52,587	6,415.61
Transport PM _{2.5} emissions	0.012	0.022	0.010	410,293	4,102.93

Total annual
offsetting amount £10,518.54

Total offsetting
amount $\{(\pounds 10,518.54) \times [(1+0.02)^{30} - 1]\} / 0.02 = \pounds 426,716.96$

A1.2 Example 2

A1.2.1 A mixed-use residential development in outer London for up to 9,271 m² of development, comprising:

- 112 residential dwellings, up to 7,688 m²
- office, up to 1,583 m²
- heating and hot water to be provided by individual boilers and air source heat pumps.

Building emissions

A1.2.2 Total NO_x emissions from the development were calculated from the generic emission rate for boilers of 40 mg/kWh, and a total annual gas usage of 500,000 kWh as provided by the energy and sustainability consultant.

$$40 \text{ mg/kWh} \times 500,000 \text{ kWh} = 20 \text{ kg}$$

A1.2.3 The total benchmarked building NO_x emission is calculated from the land use categories and the BEBs for individual gas boilers (as the gas boilers do not form a network with the ASHPs), as shown in Table A1.6.

Table A1.6 Calculation of BEB (Example 2)

Land use	GIA (m ²)	Benchmark emission rate (g/m ² /annum)	Total benchmark emissions (kg)
Residential	7,688	3.5	26.9
Office	1,583	1.43	2.3
Total			29.2

A1.2.4 The total building emissions (20 kg) are less than the total BEB (29.2 kg). The development is thus Air Quality Neutral in terms of building emissions.

Transport emissions

A1.2.5 The transport assessment for the development predicted that the development will generate a total of 113,100 car trips per annum, comprising trips relating to each of the following land use classes:

- 112 residential dwellings, up to 7,688 m²
- office, up to 1,583 m²

A1.2.6 The TEB has been calculated as shown in Table A1.7.

Table A1.7 Calculation of TEB (Example 2)

Land use	GIA (m ²)/no. dwellings	Benchmark trip rate	Total benchmark trip rate
Residential	112 dwellings	447	50,064
Office	1,583	16	25,328
Total (TEB)			75,392

A1.2.7 The total development trip rate is greater than the TEB. The development is thus not Air Quality Neutral in terms of transport emissions.

Entire development

A1.2.8 While the development was Air Quality Neutral in terms of building emissions, the total trip rate exceeded the TEB and thus mitigation of transport-related emissions would be required.

A1.3 Example 3

A1.3.1 A residential development in inner London for 38,753 m² of development, comprising:

- 428 residential dwellings, up to 38,478 m²
- retail, up to 125 m²
- on-site gym, up to 150 m²
- heating and hot water to be provided by air source heat pumps with an emergency diesel generator to be tested 12 hours per year.

Building emissions

A1.3.2 The development's heat demand will be entirely met by ASHPs, which have no heat-related NO_x emission, and no BEB is defined. The diesel generator will not be used for any purpose other than for routine testing and maintenance.

A1.3.3 The development is therefore Air Quality Neutral in terms of building emissions.

Transport emissions

A1.3.4 The transport assessment for the development predicted that the development will generate a total of 9,163 car trips per annum, comprising trips relating to each of the following land use classes:

- 428 residential dwellings, up to 38,478 m²
- retail, up to 125 m²
- on-site gym, up to 150 m².

A1.3.5 The on-site gym is not expected to generate any trips as it is solely for use by residents. The trip rate benchmark calculation should therefore not include trips relating to the gym floorspace.

A1.3.6 The TEB has been calculated as shown in 0.

Table A1.8 Calculation of TEB (Example 3)

Land use	GIA (m ²)/no. dwellings	Benchmark trip rate	Total benchmark trip rate
Residential	428 dwellings	114	48,792
Retail	125	139	17,375
Total (TEB)			66,167

A1.3.7 The total development trip rate is less than the TEB. The development is therefore Air Quality Neutral in terms of transport emissions.

Entire development

A1.3.8 The predicted building and transport emissions are less than the BEB and the TEB. The development is therefore Air Quality Neutral and no further mitigation is required.

A1.4 Example 4

A1.4.1 A mixed-use residential development in inner London, comprising:

- 290 residential dwellings up to 25,000 m²
- retail, up to 950 m²
- an energy centre comprising four gas-fired boilers.

Building emissions

A1.4.2 Total NO_x emissions from the development were calculated from the generic emission rate for gas boilers of 40 mg/kWh, and a total annual energy usage of 3,750,000 kWh as provided by the energy and sustainability consultant.

$$40 \text{ mg/kWh} \times 3,750,000 \text{ kWh} = 150 \text{ kg}$$

A1.4.3 The total benchmarked building NO_x emission is calculated from the land use categories and the BEBs for a gas boiler network, as shown in Table A1.9.

Table A1.9 Calculation of BEB (Example 1)

Land use	GIA (m ²)	Benchmark emission rate (g/m ² /annum)	Total benchmark emissions (kg)
Residential	25,000	5.7	142.5
Retail	950	0.97	0.92
Total			143.4

A1.4.4 The total building emissions (150 kg) are greater than the total BEB (143.4 kg). The development is therefore not Air Quality Neutral in terms of building emissions.

Transport emissions

A1.4.5 The development will be 'car-free' and will only provide disabled persons car parking. It can thus be assumed that the development will meet the TEB and is therefore Air Quality Neutral in terms of transport emissions.

Entire development

A1.4.6 While the development was Air Quality Neutral in terms of transport emissions, the total building emissions exceeded the BEB. Thus, mitigation of building-related emissions would be required should no changes to the proposal be made.

Offsetting

A1.4.7 In the event that suitable mitigation cannot be agreed between the applicant and the local planning authority, an offsetting payment would need to be agreed to mitigate the excess building emissions. The excess emissions are multiplied by the relevant damage costs and multiplied over 30 years, with a 2 per cent annual uplift, to give the total offsetting payment of £4,876.28 (see Table A1.10).

Table A1.10 Calculation of offsetting payment (Example 1)

	Benchmark (tonnes/ annum)	Total predicted emissions (tonnes/ annum)	Excess emissions (tonnes/ annum)	Damage cost (£/tonne)	Annual offsetting amount (£)
Building NO _x emissions	0.143	0.150	0.007	17,171	120.20
Building PM _{2.5} emissions	0	0	0	N/A	N/A
Transport NO _x emissions	N/A	N/A	N/A	N/A	N/A
Transport PM _{2.5} emissions	N/A	N/A	N/A	N/A	N/A

Total annual
offsetting
amount £120.20

Total
offsetting
amount $\{(\pounds 120.20) \times [(1+0.02)^{30}-1]\}/0.02 = \pounds 4,876.28$

Appendix 2 Application to a Phased Energy Strategy

This appendix provides a worked example of how a large, phased development should be brought forward to ensure the development remains compliant with the Air Quality Neutral benchmarks.

- A2.1.1 An applicant is seeking permission for a six-phase development, with Phases 1 and 2 set out as detailed proposals and Phases 3 to 6 in outline. A district heating network is proposed, with the energy centre to be built in Phase 3.
- A2.1.2 At the initial application stage, the AQN Assessment should include:
- an assessment of all phases together (both detailed and indicative) to show that the whole scheme, once completed, is capable of meeting the Air Quality Neutral benchmarks
 - an assessment of the detailed proposals for Phases 1 and 2 based on the interim energy strategy (that is without the energy centre, as this is delivered in Phase 3).
- A2.1.3 If substantial changes are made to Phase 2 (after initial permission is granted) that are likely to change the building emissions, a revised assessment of the new detailed proposals should be made based on the new interim energy strategy.
- A2.1.4 When the detailed proposals for Phase 3 are brought forward, including the initial operational phase of the energy centre, the AQN Assessment should include an assessment of Phase 3, and Phases 1 and 2 if connected to the energy centre, as it will operate at the completion of Phase 3. This should show that Phases 1 to 3 are Air Quality Neutral upon connection to the energy centre.
- A2.1.5 If the design of the energy centre or the proposed quantum of development has changed since the outline application, the assessment of the full 6-phase development (including indicative plans for the remaining phases) should be reviewed to ensure the final development is still capable of meeting the benchmarks.
- A2.1.6 When the detailed proposals for Phases 4 to 6 are brought forward, each phase should be assessed following the principles set out in section 3.4 on connecting to heat networks.
- A2.1.7 As well as ensuring that the aims of the policy are delivered, this approach should allow developers sufficient flexibility to evolve the energy strategy over time as technology changes or to address any significant changes in the development proposals.

