London Plan Consultation Response 02.03.18
London Energy Transformation Initiative

The London Energy Transformation Initiative (LETI) is a network of over 300 built environment professionals that are working together to put London on the path to a zero carbon future. The voluntary group is made up of developers, engineers, housing associations, architects, planners, academics, sustainability professionals, manufacturers, membership bodies, contractors and facilities managers, with support and input provided by the GLA and London boroughs.

LETI has published two papers that put forward recommendations for the London Plan. The first, Getting to zero - proposals for energy policy sets out principles that should be included in policy. The views in this represent a high level consensus of members and LETI energy policy proposal supporters and supporter organisations. The second, Getting to zero- draft London Plan consultation response reflects the discussions from the London plan workshop and further discussions with the LETI taskforce.

Dear Mayor,
We acknowledge that global temperature rise needs to be kept below 1.5 degrees to avoid catastrophic climate change. To achieve this, all new buildings must operate at Net Zero Carbon by 2030 and existing buildings by 2050. As a global city, London has a responsibility to help lead the transition to a low carbon future.

We, as concerned citizens, believe that current policy in London relating to carbon emissions from buildings will not deliver Net Zero Carbon for new buildings by 2030. We strongly recommend that the London Energy Transformation Initiative proposals are implemented in the London Plan and the London Environment Strategy to put London on the right trajectory. We believe these proposals will help in the delivery of buildings that are more energy efficient, produce fewer carbon emissions, and are less expensive to occupy.

We commit to doing everything in our power to implement practices within our work that supports and accelerates London's trajectory towards operational zero carbon buildings, including using the principles set out by the London Energy Transformation Initiative.

Kind Regards
The London Energy Transformation Initiative (LETI) and the LETI energy policy proposal supporters signed below

LETI workshop May 2017

LETI workshop Jan 2018


4green
architecture


the EDGE


Allies and Morrison


Bioregional


como


Feilden
Clegg
Bradley
Studios


BENNETTS
ASSOCIATES


BDP.
d:for
We design for...


Etude


CIBSE
Resilient Cities


icax
INTERSEASONAL HEAT TRANSFER


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Civic Engineers


THE
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XCO2


Good
Homes
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TwinnSustainabilityInnovation
Buildings that do not cost the Earth


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An initiative by

elementa

Member of Integral Group

GETTING TO ZERO

LONDON ENERGY TRANSFORMATION INITIATIVE:

PROPOSALS FOR ENERGY POLICY

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A special thanks to the below, without their support this initiative would not have been able to be so successful.

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Acknowledgements

Elementa Consulting have initiated and coordinated the London Energy Transformation Initiative and edited this summary report.

Report Authors

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MEng Low Carbon Consultant

Clara initiated the process of collaboratively developing energy policy recommendations which began with publishing an article in the CIBSE Journal. She then coordinated the 'Fixing London's Broken Energy Policy' workshop and edited the summary report of the workshop - **Getting to Zero- developing policy recommendations for a zero emissions capital.** Since then she has coordinated the London Energy Transformation Initiative. She was recognised as the UKGBC Rising Star of 2017 partly in recognition of her work on energy policy and low energy building design, and is a Mayor's Design Advocate for Good Growth.

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MSc, BSc

Adam leads Currie & Brown Sustainability Services team. He specialises in helping policy makers, clients and occupiers to make the business case for sustainable buildings. Adam has led teams in the review of national, local and corporate building standards and also in providing practical support to a wide range of development projects.

Thomas Lefevre - Etude - Director
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Thomas is a Sustainability Engineer and works on projects at all stages: design, construction and operation. He has also collaborated with the London Boroughs of Tower Hamlets and Islington on their carbon policy. Thomas is an environmental sustainability advisor to the University of Manchester, a member of the Islington Design Panel and a Built Environment Expert for the Design Council.

Amanda Stevenson - Capital & Counties Properties Plc - Head of Sustainability
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Amanda is Head of Sustainability for Capco, a London property company with two key assets focused on Earls Court and Covent Garden. Amanda is responsible for implementing the company's sustainability strategy, of which a key focus area is driving for improved energy efficiency in both existing buildings and in new developments.

Stephen Kent - CBRE - Sustainability Consultant
BA (Hons), BREEAM AP, Low Carbon Consultant

Stephen is a Sustainability Consultant with experience of a wide portfolio of projects at all stages of the building lifecycle. He specialises in working collaboratively with all elements of the industry to deliver commercially viable sustainable / low carbon solutions for today's environmental challenges.

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Foreword

You are a participant in the biggest competition that humanity has ever faced, and it has a timer. In order to win this competition, leading global cities have embraced measured performance-based targets to benchmark carbon emissions of their existing infrastructure and have already begun phased implementation plans to continuously reduce emissions over time – all the way to zero emissions.[1] These cities are leading their communities and nations. It is imperative that London join their ranks to remain competitive. This requires that we move away from theoretical baselines towards actual in-use performance for the baseline and proposed case.

London is special in the UK, in that it has the authority to write its own energy policy, Chapter 5 in the London Plan. In essence it has the ability to be a shining light and lead not only the UK but the world. With the right policy measures in place, coupled with London's innovative mix of local councils, active communities, businesses, universities and research institutes, we have an opportunity like no other to find and rapidly test simple and creative solutions.

We must ask ourselves the question, 'what does an international, leading energy policy look like?' Fundamentally, policy can be a tide that raises all ships if it is: evidence based and outcome driven, it improves access and opportunity for all constituents, it increases choices and avenues for success, and discourages avenues that unequally serve the few to the disadvantage of the many.

Now, more than ever, this requires envisioning a future without regrets. A future when we can collectively tell our children and our grandchildren, 'we stood up to cynicism, perfectionism and procrastination – and together we took a courageous step toward a healthy, equitable and regenerative future for all Londoners.'

You have shown, as Londoners, through participating in the Getting to Zero Workshop in May (over 100 industry stakeholders in attendance) and this Summer's London Energy Transformation Initiative - LETI (targeted working groups based on the Workshop outcomes, comprising over 50 industry experts) that you are ready for this step change. The policy measures and recommendations in these reports are simple and actionable – and will lead to real, measured reductions in carbon emissions. Rewriting policies that are no longer delivering real measured energy and greenhouse gas emissions savings will require a lot of work.

It is now clear that climate change is upon us, not something that future generations will solve but something we must solve now. There is undeniable evidence, rooted in peer reviewed science, that humanity's overuse of natural resources and carbon based fuels will soon lead to irreversible climate change. The window of time to take actionable steps is steadily closing right now.

I have had the great fortune to work on leading projects, in North America and now the UK that have achieved and aim to achieve such accolades as the International Living Future Institute's Net Zero Energy Certification, which we are now able to deliver using off-the-shelf technology. And it is my personal belief, that we must throw our support behind these renewable and energy efficient solutions that are already at scale today. These technologies have the following key attributes: existing global supply chains, locally available to installers, low maintenance, and most importantly production is increasing and prices are falling. These technologies include: Solar photovoltaics, Large scale wind energy (on and off shore), Energy storage and batteries, Heat pumps (for heating and cooling).

Other exciting and interesting technologies are currently in development but we cannot wait for these to reach scale. We cannot base our decisions on a future promise, it must be based on present data. Remember, time is constantly working against us. Research funding through government agencies and philanthropic institutes will have a role to play for pilot projects to make the next big step change using advanced technologies that are not yet at scale. In regards to today's policies pertaining to the built environment, in the developed world, we must make a bold move toward all electric systems, with zero combustion.

Having read and reviewed the 4 proposals developed by the LETI Task Force and delivered to the Greater London Authority it is clear that these proposals will allow London to be a leading international city. These recommendations follow in this report. I strongly add my support and believe that these recommendations will open new pathways for low cost, low carbon solutions to be delivered with immediate effect by project delivery teams.

Following a successful meeting with the Greater London Authority on 15 September, 2017 at London City Hall, it is time to amplify our voices.

We are asking you to do 3 things to amplify your voice:

1. Add your personal signature

Click here to sign up to support the LETI proposals

2. Convince 10 Londoners (friends and family) to add their signature
3. Create a task force in your place of work and convince an individual in your company to sign up – and then request that your company throw its brand behind these recommendations

When the severe impacts of climate change are weighed in the balance, we will all still be alive and we'll be able to look back at this moment and say, 'I stood up to be counted, I called my friends, family and colleagues to join together so we would be heard.'

I, for one, strive to live a life without regrets. I want to keep moving forward learn from my mistakes and my peers and then let go of the past. When it comes to improving the lives of all people everywhere, it is my hope that we are never satisfied and that we always remember the power of collective, positive action.

I personally want to thank Clara Bagenal George for her leadership, collaborative approach and inspiration – without your positive attitude and diligence, none of these achievements and collective thinking from the industry would have been realised.

To a future without regrets,

[redacted]

Benjamin J. Galuza, PE, LEED AP, LBC Amb, Fitwel Amb,
BSc Mech Engineering, MSc Sustainable Design
Principal, of Elementa Consulting, Member of Integral Group


FAIL

Executive summary

Climate change prevention, adaptation and resilience are reputation defining issues for world class international cities. Leading cities have already begun tackling this challenge by revamping their energy and environmental policies[2345] to conserve resources whilst improving the quality of urban living.

The leading policies from around the world utilise measured real performance to track progress against targets[6]. To avoid the most devastating effects of climate change, all new buildings must operate at net zero carbon by 2030 and existing buildings by 2050[7]. This is in line with the Mayor's ambition for London to be a Net Zero Carbon city by 2050. As a global city, London has a responsibility to help lead the transition to a low carbon future.

Chapter 5 of London's spatial strategy, the London Plan, along with the Greater London Authority (GLA) guidance on preparing energy assessments identifies the purpose, content, and output of an energy strategy as part of the planning application for a new development. Only through the evolution and realignment of these two documents will London see a purposeful carbon reduction programme. Last year the Mayor set out in his document 'A City for all Londoners' that he will be looking to publish a revised London Plan for consultation in 2017. The London Energy Transformation Initiative (LETI) was established in order to input fresh thinking, based on practitioners' experience, to how a new London Plan's energy and climate policies could evolve.

LETI believes that current policy relating to carbon emissions in buildings in London will not deliver Net Zero Carbon for new buildings by 2030 and therefore recommends the following proposals be implemented in policy to get us on the right trajectory. We believe these proposals will help in the delivery of buildings that are more energy efficient, lower carbon and less expensive to occupy.

This report mainly covers new build domestic and non-domestic developments. It also covers data disclosure of existing non-domestic buildings and community and district heat systems.

It is important to acknowledge that large scale energy refurbishment works will need to be carried out to the majority of existing buildings, as well as ensuring that all new buildings are Net Zero Carbon to ensure that we limit global warming to 1.5°C.[8]

1. Revise London Plan Energy Strategy targets

- Update carbon factors and ensure that they are updated regularly in the future
- Introduce a kWh/m² energy use target
- Introduce a fabric energy efficiency target
- Introduce a demand response and peak demand reduction statement in planning applications
- Introduce an onsite renewable energy generation target
- Continue to declare predicted carbon emissions at planning stage

2. Heat Networks

- Require all networks to provide a strategic district energy local plan that includes a Zero Carbon transition plan
- Require all new developments to adopt the 'delivering low carbon heat' hierarchy

3. Offset Payments

- GLA to provide guidance on the implementation of the carbon offset policy
- Require annual reporting to GLA relating to offset funds by London boroughs
- Update offset payment calculation methodology to include total building energy use, regulated and unregulated
- Introduce staged payments
- Update the cost of offset

4. Energy use disclosure

- Require all new buildings to disclose in-use energy data
- The introduction of a 'Be Seen' step to the energy hierarchy
- Require data disclosure for all non-domestic buildings
- Require block level central systems efficiency, carbon intensity and energy cost disclosure for domestic buildings
- Require detailed building performance data
- Incentivise the energy efficient operation of buildings

Introduction

The London Energy Transformation Initiative (LETI) is a cross sector group of professionals who have come together to develop strategies around London's built environment, building consensus on acceptable recommendations needed to make London a Zero Carbon Emissions capital.

The voluntary group is made up of developers, engineers, housing association representatives, architects, planners, academics, sustainability professionals, contractors, and facilities managers, with support and input provided by the GLA and London boroughs. LETI was initiated and co-ordinated by Elementa Consulting. Clara Bagenal George and Ben Galuza led the initiative.

Click here for the first "Getting to Zero" report that summarises the outcomes of the initial workshop undertaken in May 2017

This report summarises the second phase of the LETI programme. Four working groups were set up to tackle key priorities from the workshop, each looking at a topic in greater detail and providing robust recommendations for implementation.

Working Groups

Working Group 1 - Data Disclosure led by Adam Mactavish (Currie&Brown)

Disclosure of energy consumption emerged as a priority from the workshop. To close the performance gap we need to create a positive feedback loop; monitoring the actual energy use of buildings, and using this data to inform design decisions for future projects in London.

Working Group 2 - Better Performance Metrics led by Thomas Lefevre (Etude)

The current London Plan specifies a minimum 35% operational carbon reduction, based on the Part L building regulations framework. There is concern that this metric cannot be checked once the building is in operation and that this approach can encourage the implementation of building and district scale strategies that will not deliver the actual required emissions reductions.

Working Group 3 - Decarbonising Energy and Heating led by Amanda Stevenson (Capco)

The operational greenhouse gas impact of buildings depends on their demand for energy and the carbon intensity of the energy supplied. The carbon intensity of the UK electricity grid continues to fall, and the greenhouse gas impact of electricity use will fall proportionally. Solutions to decarbonise heat supply need to be developed.

Working Group 4 - Delivery Mechanisms led by Steven Kent (CBRE)

The only way in which the potential energy and consequential carbon savings identified will be realised, is through the application of robust delivery mechanisms to drive the industry.

Full reports and names of all participants from each of the working groups are appended to this document.

The LETI Taskforce met twice monthly throughout the summer, to review and coordinate the development of the working groups and agree the LETI proposals. The aim of this document is to draw together the recommendations from the working groups and produce a set of recommendations for the GLA that industry can sign up to ahead of the Mayor's forthcoming consultation on the London Plan. The views in this document cannot be taken to represent the views of all members of LETI, however they do represent a high level consensus of members. We will endeavour to amass signatures by the broader London community to support these recommendations and illustrate their viability.

Click here to sign up to support the LETI proposals

London Environment strategy

This report also forms a response to the consultation of Chapter 6 - Climate change mitigation and energy of the Mayor's Draft London Environment strategy[9] that was published for consultation in August 2017.

1. Do you agree that the policies and proposals outlined will meet the Mayor's ambition to make London a zero carbon city by 2050? Is the proposed approach and pace realistic and achievable?

The Mayor outlines ambitions for London to be a zero carbon city by 2050. The strategy states that all new buildings will be zero carbon from 2019, and therefore no further milestones need to be set in place. However, the current definition of zero carbon, as set out in the current London Plan (at least 35% carbon emission reductions from a notional building to be achieved onsite, with an offset paid for the remaining regulated carbon emissions) remains far away from a position where buildings emit no carbon emissions. In order to have actual impact in the fight to slow and reverse climate change, it is recommended that the proposals set out in this document are implemented.

Proposals 1-3 of this report set out recommendations that address the following policies/proposals of the draft London Environment Strategy:

- Objective 6.1 Reducing carbon emissions of London's homes and workplaces while protecting the most vulnerable by tackling fuel poverty
- Policy 6.1.4 Ensure that new developments are zero carbon
- Proposal 6.1.4a Through the London Plan the Mayor will consider policies to support the delivery of zero carbon development
- Proposal 6.1.3b Supporting reducing emissions and energy within the commercial sector including through improved building management, energy efficiency and reporting
- Proposal 6.1.4b Support the design of effective methods to ensure the energy and carbon performance of new developments meet their agreed design standards

Proposal 4 of this report details methods that are recommended to achieve the policy's/proposals of the draft London environment strategy show below

- Objective 6.2 Develop clean and smart, integrated energy systems utilising local and renewable energy resources
- Policy 6.2.1 Delivering more decentralised energy in London
- Proposal 6.2.1a Help implement large scale decentralised and low carbon energy projects, including stimulating demand from the GLA group
- Policy 6.2.2 Planning for London's new smart energy infrastructure
- Proposal 6.2.2a Encourage the identification and planning of decentralised energy in priority areas
- Proposal 6.2.2c Investigate the potential for further smart, flexible energy system demonstrators and pilots where Londoners can help manage demand

Collaboration with the London Environmental Coordinators Forum (LECF)

The London Environmental Coordinators Forum (LECF) has conducted two surveys on the implementation of the London Plan's Carbon Reduction Standard (policy 5.2). LECF has been involved in the LETI working groups and members of LETI have taken part in the LECF study.

The LECF study 'A Review on Delivering London's Carbon Reduction Standards' puts forward recommendations to the GLA, many of which are aligned to the LETI proposals outlined in this report including: the introduction of the kWh/m^2 energy use metric and a fabric performance metric, energy use disclosure and ensuring that all developments and district heating schemes have a plan in place to deliver heat without the use of fossil fuels.

https://www.leti.london/

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Adam Mactavish - Currie & Brown
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LETI Proposal 1 - Revise London Plan Energy Strategy Targets

The current planning targets based on using Building Regulations Part L[10] compliance tools and percentage carbon emissions improvements over a notional building encourage a culture of false reporting and thus do not lead to best practice design and performance. Furthermore the planning stage carbon emission metrics cannot currently be measured once a building is in operation, which makes it impossible to quantify the impact of the planning policy, at a building scale or London-wide.[11]

1.1 Immediate Actions

Carbon Factor to be immediately updated in current policy

Currently the estimated CO_2 reductions of a development, reported in the planning submission energy strategy, is calculated using the carbon factors stated in building regulations (519 gCO_2/kWh for grid electricity[12]). This significantly overestimates the carbon emissions related to electricity in the development. This is due to the fact that the carbon intensity of the electricity grid is much lower than stated in building regulations, as the carbon intensity of the grid has reduced over the last 10 years. In 2016 the average UK electricity grid carbon factor was 254 gCO_2/kWh[13]- less than 50% of the value used in Part L of the Building Regulations.

In order to provide a robust CO_2 reduction estimation the use of the appropriate carbon factors is vital. The use of overestimated carbon factors for electricity has had significant knock-on consequences for the current business as usual approach in London. This has resulted in natural gas-fired Combined Heat and Power (CHP) still being installed as it is theoretically shown to reduce carbon emissions of the development in the energy strategy. The reality is that natural gas CHP is no longer always a net carbon reducer – thus not the solution to realise a zero carbon development or building.

It is proposed that the GLA lobby the government to make sure appropriate carbon factors are used for Building Regulations and updated regularly.

The GLA should publish guidance of what carbon factors are to be used, using current carbon factors and/or future carbon factors, and update this guidance regularly. The guidance should also include how these carbon factors should be used to compare a development's carbon emissions with those of the notional building. Delays in update of the carbon factors in Building Regulations should not jeopardise London's carbon pathway.

1.2 London Plan and London Environment Strategy proposals

It is proposed that the following be included in an energy strategy that is produced at the planning approval stage.

A. Predicted energy use

B. Fabric energy efficiency target

C. Demand response and peak demand reduction measures

D. Onsite renewable generation targets

E. Predicted carbon emissions

A. Predicted Energy Use

Putting in place a metric that is clear, simple to understand and readily comparable between buildings is fundamental. In line with building performance standards used internationally, a total energy consumption kWh/m^2 (energy use) metric is proposed. This includes both regulated and unregulated energy and will replace the current CO_2 emission compliance methodology.

A kWh/m^2 energy use metric is used in Toronto's zero emissions buildings framework[3], Vancouver's Zero Emissions Building Strategy[1], the Canadian Green Building Council's Zero carbon building standard[4] and the Passivhaus standard[14].

The kWh/m^2 metric provides a consistent indicator to be measured at each stage of the design process and ultimately and most importantly, during operation allowing identification of the most successful approaches.

Implementation will require realignment of the energy modelling approaches currently used, allowing for a single standardised approach being followed, with inbuilt flexibility to allow designers to follow different design approaches to demonstrate compliance.

Minimum energy use targets will be set for different building types based on published performance data, to be reviewed regularly. It is recommended that the energy use targets become tighter every few years, for continual site energy reductions to 2030, as we move towards a net zero carbon buildings and a zero carbon capital.

This means that the development will still have to show compliance with building regulations once it has been built, but will not have to meet a certain percentage carbon emission reduction compared to the notional building at planning stage.

B. Fabric Energy Efficiency Target

An efficient building fabric drastically reduces energy consumption, makes the building more resilient to weather extremes and decreases capital and maintenance expenditures on active building services. The risk of 'locked-in' inefficiency in the building fabric is more acute than that of building services – getting it right the first time is much less challenging than a 'fix it later' approach.

It is proposed to include a fabric energy efficiency target, which takes into consideration both heating and cooling. Examples include the Thermal Energy Demand Intensity[15] used in Toronto's zero emissions buildings framework, Vancouver's Zero Emissions Building Plan and the Canadian Green building council's Zero carbon building standard. Other examples include the Fabric Energy Efficiency Standard (FEES)[16] from the Zero Carbon Hub and the Overall Thermal Transfer Value (OTTV)[17] used in Hong Kong.

C. Demand response and peak demand reduction measures

As the electricity grid decarbonises, using electricity to generate heating and domestic hot water, (typically through heat pumps[18]) becomes a cost effective, energy efficient and low carbon solution, and it appears likely that more heating and domestic hot water will be delivered by electricity over time.

However, electric solutions (for heating and cooling) will put continued and growing pressure on the electricity grid, exacerbated further by the additional expansion requirements to meet the demand from the increase in electric vehicles.

This will drive the need to reduce peak requirements of electricity likely to be at its most acute during winter evenings when heating and vehicle charging is required (and output from solar renewable energy is low.) Without careful management of the electricity grid, there could be concerns over power blackouts.

Policy should look at ways to dis-incentivise consumption during peak periods or provide complementary systems onsite to meet potential peak demands – whether through battery storage, thermal storage and other smart demand management systems. The Energy Strategy for the development should clearly demonstrate how peaks will be reduced and what peak reducing measures will be incorporated as part of the building operation; this builds on paragraph 5.22a of the current London Plan. Appropriate guidance should be made available to designers to ensure desired outcomes.

This information should be used by the GLA to understand what peak reductions can be achieved for different types of development and mandatory peak reduction targets could be introduced in the future.

Where smart meters are installed time-of-use electricity tariffs that disincentives using electricity at peak times are available in the UK for both residential[19] and commercial developments[20] and are likely to become more widespread. The California energy code compliance methodology includes specific disincentives for energy used during peak grid demand periods through the use of Time Dependent Valuation (TDV) of Energy.[21]

D. Onsite renewable generation target

Currently, onsite energy renewable generation is encouraged through the *Be Green* section of the energy hierarchy that contributes to the carbon emission reductions compared to the notional building.

The kWh/m^2 energy usage target, proposed in this report, accounts for technologies that increase the efficiency of the systems (e.g. heat pumps), but does not include renewables that generate energy, for example solar photovoltaics (PV) that generate electricity or solar thermal panels that produce heat.

It is important that onsite generation is still encouraged. To ensure the solar potential of the roof is fully realised, it could be mandated to install solar renewable technologies on a certain percentage of roof area. This percentage area could be recommended by the GLA and set by boroughs, depending on whether the boroughs would like to focus on green roofs or solar energy generation (although the two are not mutually exclusive and indeed can have beneficial synergies, but requiring both may be seen as overly onerous in some cases).

E. Predicted Carbon Emissions

The merits of providing a simple, clear, and comparable energy performance metric have been demonstrated in the previous sections. However, meeting London's zero carbon target requires a reduction in emissions, therefore predicted carbon emission reductions still need to be reported, as has been the case for a number of years.

Therefore, it is proposed that while a kWh/m^2 become the main compliance metric for technical reasons, carbon emissions should still be reported in the Energy Strategy to allow progress to be tracked against climate change targets.

LETI Proposal 2 – District Energy Networks

Decarbonising heating and hot water in London is essential to meet the Mayor's carbon reduction goals, but it is not without its challenges. There are various schools of thought of what the future of heating will be: heat pumps, fuel cells or CHP fuelled by biogas, hydrogen or low carbon electricity and whether it will be delivered locally or using district systems.

The priority must therefore be to ensure that policy drives decision-making that delivers long term carbon emission reductions in a way that gives the designers flexibility to incorporate engineering strategies that are appropriate to the building use. Resilience should be encouraged with systems that are technology neutral that can adapt to future technologies and building uses.

District heating is often mentioned alongside combined heat and power (CHP). This is because many communal and district heating schemes used natural gas CHP, as it is an economical way of generating heat, once the benefits of generating electricity are taken into account; 10 years ago it was also a very low carbon method of generating heat and electricity. The carbon emissions savings potential of natural gas CHP has reduced over the last 10 years as the carbon emissions of the electricity grid have reduced. It is therefore important to be clear about the distinct concepts: district heating describes a situation where heat is generated at single, or multiple, locations and then distributed to multiple buildings, CHP is just one technology used to generate heat.

District heating itself can be beneficial because an energy centre, typically employed in such schemes, can be easily maintained and adapted to use lower carbon technologies as they become available (i.e. switching gas fired boilers or CHP to large scale heat pumps or fuel cells, utilising waste heat, switching the fuel from natural to biogas, and so on). Large scale thermal stores can also be incorporated in the energy centre, reducing peak heating demand. Furthermore, when district heating connects buildings with different demand patterns, peak heating demand is levelled out, increasing the efficiency of the system.

The ability to switch to more efficient or lower carbon fuel sources is key for heat networks to be part of the solution to delivering low carbon heat. This must be thought through from the beginning, with considerations including appropriate flow and return temperatures for the network. The temperature of a heat network matters because the systems in a building are designed according to the temperatures of the heat network. Therefore changing temperatures of the heat network will affect the output of heat emitters and other terminal devices, which may then need to be replaced.

Currently, developments are typically obliged to utilise a district (communal) heating solution on site – and/or connect to a district heating system where one is available (and has sufficient capacity to connect to), regardless of either the efficiency of the district heating system or whether or not connecting into the system will actually achieve a reduction in carbon emissions, compared with alternative on-site solutions. This is acting as a positive dis-incentive for project innovations focused on next-step reductions in thermal demand and developments that want to achieve zero combustion fossil fuel free heat on-site.

In practice some district and communal heating systems operate with low efficiencies[24] and at a high cost to the end user[25]. This is a problem as district heating networks are a natural monopoly.[26] The heat trust is a voluntary consumer protections scheme[27] that has been set up to address this. The London Heat Network Manual[28] and the CIBSE Heat Networks Code of Practice for the UK[29] give guidance on the design, construction, commissioning and operation of Heat Networks.

The appropriate selection of low carbon technologies for heat networks needs to also consider air quality implications and potential HFC fugitive emissions from heat pumps.

2.1 Options for Decarbonising Heating

Three options for delivering low carbon heat are described below:

A. Generating fossil fuel free heat onsite

Communal heating or heating of individual units for both residential and commercial blocks, for example through the use of local heat pumps or waste/secondary heat sources.

B. Connecting to an extra-low grade heat network

An extra low grade heat network delivers heat at a temperature of around 50 degrees (sometimes known as 4th generation district heating[30]). This means the hot water for the heat network can be generated by heat pumps (now or as a switch to heat pumps in the future), and the delivery losses are reduced compared to a network where heat is distributed at higher temperatures.

C. Connecting to an energy sharing network

When providing cooling to a building, heat is rejected by cooling and refrigeration plant, normally into atmosphere. Within central London this contributes to the London urban heat island (UHI) effect and is wasteful as this heat could potentially be used in buildings. In the medium term, this is expected to be classified as an environmental pollution discharge (as is already the case for discharges to rivers)[31]. Capturing and using waste heat to provide heating is referred to in this document as 'energy sharing', which is facilitated by an ambient loop. Heat is taken from, or rejected to, this loop depending on whether heat or coolth is needed, via connection heat pumps at either building or block level. The connection heat pumps can operate at a significantly higher Coefficient of Performance (CoP) connecting to the ambient loop rather than atmosphere. In this way energy is shared and the heating and cooling loads in the building are reduced. The building design emphasis then changes to smoothing out heat demands and surpluses so that they can be better managed by the network. This principle works towards 'Heat Autonomy' – where a development sources all of its thermal energy needs from waste on site.

Notes:

1. Where combustion occurs, mitigation measures must be put in place to prevent air quality degradation.

2. Heat pumps are categorised as fossil fuel free. The carbon emissions associated with electricity have significantly decreased over the last 10 years and will need to continue to decarbonise if we are to meet our climate change goals. When heating is provided through heat pumps it is seen as fossil fuel free as there are no fossil fuels combusted on-site and the technology has the potential to deliver fossil fuel free heating as the electricity grid moves towards a zero carbon future.

2.2 London Plan and London Environment Strategy Proposals

2.2.1 A District Energy Strategic Plan

This report proposes that all 'networks' and communal heating systems must have a local district energy strategic plan that addresses the following considerations:

Cost

- The commercial delivery of the plant must be detailed, including a platform for the transparent billing of customers
- The actual cost paid by the end user must not be more than the average household energy bill[32] for heating or an agreed pricing index for residential developments. Costs must include operation and maintenance of the heat network.

Interconnectivity

- The interconnectivity with other heat or energy sharing networks must be set out as part of area-wide energy and planning strategy of the heat network, to highlight the longer growth proposals for the network.
- Possible links should be explored to provide heat to existing buildings.

Zero Carbon Transition Plan

- A London Zero Carbon Transition Plan should be produced by the network, which shows how the heat networks will deliver fossil fuel free heat by 2030 with no negative impact on air quality. This transition plan must be updated and submitted to the GLA every 5 years and kept on a central database.
- All new heat networks must distribute low grade heat to facilitate use of fossil free fuel sources.
- Where a heat network already distributes heat at a higher temperature than 50^{0}C, it needs to be demonstrated how and when the network and buildings served will transition to a low grade heat approach (unless the heat produced is 100% waste heat).

Data Disclosure

- The energy network must publically report on annual efficiency, distribution losses, costs to users and actual carbon factors
- The Mayor should then use the information to publish online a London district heating report, outlining the prices typically paid by consumers and the efficiency of the district heating systems.

It is suggested that the district energy strategic plans be guided by local authority wide energy strategies that set out potential sources of waste heat, other heat networks, etc. These types of strategic plans have been used in Denmark[33]. The London Heat Map would be used as a basis and extended[34].

2.2.2 A 'Delivering Low Carbon Heat ' Hierarchy

This report proposes that the following 'delivering low carbon heat' hierarchy is adopted in the revised London Plan when designing the heating and cooling system for new buildings.

1. Reducing heating loads through implementation of:
    - Fabric energy efficiency, using the fabric energy efficiency target outlined in Proposal 1
    - Use of energy sharing loops where appropriate (see 2.1c)
2. Inclusion of energy storage for example batteries and thermal stores, thermal mass and demand response control measures for heat and electricity.
3. Connecting to an 'extra-low grade heat network' or 'energy sharing networks' in the area, which must adhere to the local district energy strategic plan described above. If the development achieves a low enough heating load and generates fossil fuel free heating, for example through the use of heat pumps, the development is not forced to connect to an energy network.
4. If there are no energy networks in the area, and the development is not fossil fuel free, a fossil fuel free plan must be proposed. This plan must be technology neutral so that the building can shift to 'fossil fuel free' without having to replace all of the services in the development.

Case Studies

District heating can utilise low carbon sources. A good example is the Drammen district heating scheme in Norway.[22] The heat was originally from a mixture of fossil fuel and biomass but a new system was designed to make a large heat pump the primary source. Currently 75% of the network heat is generated from ammonia heat pumps with 15% from biomass and 10% from gas/oil. This scheme is also a good example of the ability of a heat network to switch to low carbon heat sources; in this case 90% of the heat is fossil fuel free.

Another example of low carbon heat networks is district heating in the False Creek neighbourhood[23] in Vancouver with 70% of heat supplied by a sewage heat pump that recovers heat from untreated urban wastewater, with supplementary solar thermal.

LETI Proposal 3 - Offset Payment

Current London Plan policy specifies that all domestic new developments in London are to be 'zero carbon', with non domestic buildings following suit in 2019.

In the context of this policy zero carbon means a building must achieve a minimum carbon emission reduction of 35% improvement on national building regulation requirements on-site (using the compliance energy model methodology) and then the remaining regulated carbon emissions must be offset for 30 years. It is important to note that this policy does not deliver zero carbon buildings, which is why LETI is advocating for a change in energy policy, as per this report.

Each local planning authority is currently free to set their own carbon price (establishing an evidence base for the price applied); where they do not take this opportunity, a default price of £60/tonne of carbon for 30 years is applied.

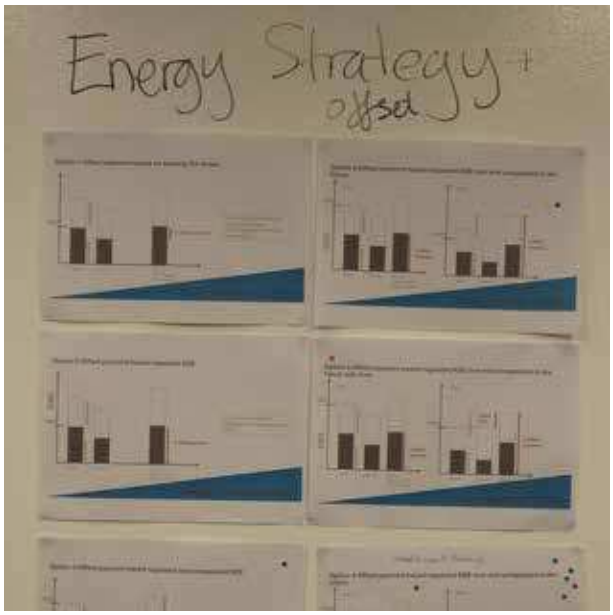
For example, if it is estimated that a development will produce 100 tonnes of carbon per year after all onsite carbon reduction solutions have been applied, then the developer must pay £180,000 to the local planning authority; this is called the 'carbon offset' and can be referred to as cash in lieu, as part of the section 106 agreement between the developer and planning authority. The local planning authority is required to ring fence any carbon offset payments, to fund the delivery of carbon reduction programmes in the borough.

A study undertaken by the London Environmental Coordinators Forum (LECF), 'A Review on Delivering London's Carbon Reduction Standards', has found that a third of London boroughs are not actively collecting carbon offset payments. Over £9m has been collected across 13 boroughs actively collecting carbon offset funds. Seven boroughs that actively enforce the policy and collect offsetting payments have spent the funds. The majority of the boroughs use the carbon price of £1,800 (i.e. £60 per ton over 30 years), however Haringey, Lewisham, Islington have the carbon costs of respectively £2,700, £3,466, and £900 (Islington includes regulated and unregulated emissions).[35]

The policy aims to incentivise developers to deliver high performance buildings, with onsite reduction through passive design, energy efficiency and generation via renewables. Unfortunately the policy is not delivering the improvements required; the reasons for this include:

- Compliance modelling methodology does not drive solutions that lead to realised (actual) carbon emissions savings
- Offset payment can be cheaper and easier than actually providing reductions as part of the development
- Local planning authorities are not necessarily spending the money generated through non-compliance payments on reducing carbon emissions
- Carbon emissions from unregulated energy are currently not included in the offset calculations (except in Islington); these form an increasingly large part of the carbon emissions from a development.

These items need to be addressed if we are to meet our climate change challenges.



3.1 Immediate Actions

3.1.1 Guidance provided by GLA on the implementation of the carbon offset policy

The GLA should provide guidance to the boroughs on the implementation of the carbon offset policy that specifies what the funding should be spent on and provides guidance on managing offset policy requirement in relation to development viability. Financial valuation has become an increasingly controversial component of the UK planning system. The research undertaken by the London Environmental Coordinators Forum states that the ability of developers to leverage pressure on councils to relax or remove planning obligations through valuation assessments can be so strong that it can force boroughs to abandon adopted policies[35]. Guidance is provided through the Homes for Londoners SPG[36] and the London Borough Development Viability Protocol[37] This guidance should be extended.

3.1.2 Carbon offset reporting by boroughs to GLA

Local planning authorities should publicly publish accessible annual reports to the GLA, outlining how funds generated from offset payments are used and how much energy and carbon has been saved as a result of this intervention. The local planning authority should spend the offset funds within 5 years, or the money would be transferred to the GLA for use on carbon reduction schemes or returned to the developer.

3.2 London Plan and London Environment Strategy Proposals

3.2.1 Offset payments based on regulated and unregulated energy consumption

The offset payment should be based on the new kWh/m^2 metric, as set out in Proposal 1; in line with the zero carbon emission ambition the offset payment should include regulated and unregulated energy consumption – providing a full representation of the future use of the development.

3.2.2 Staged payments

In providing a stage payment process for any required carbon offset it is proposed that 50% of the payment is to be paid at the time of the planning submission and 50% at the end of detailed design. This timing is to provide further incentive for design teams and contractor teams to make additional improvements leading to additional carbon reductions, reducing the detailed design payment.

3.2.3 Cost of offset

The cost of a tonne of carbon should be set at a level that incentivises on-site carbon emission reduction. This value should be reviewed to regularly ensure that this remains the case in the future, with the value of carbon reflecting changes in the price of technology. The research undertaken by the London Environmental Coordinators Forum recommends increasing the cost of offsetting to £3,600 per tonne (covering a 30 year period, compared to £1,800 currently)[38].

LETI Proposal 4 - Energy Usage Disclosure

Disclosure of building energy use is a central component underpinning progress in reducing carbon emissions and running costs. Disclosure brings many benefits, such as providing:

- Clear information on the real performance of buildings, thereby incentivising building providers (developers and landlords) to seek the best possible real performance rather than modelled compliance with regulations.
- Enhanced understanding of the way in which buildings use energy, enabling policy makers, designers and building managers to achieve better outcomes from their work.

In common with most of the UK, there is currently very little disclosure of property specific data on the operational energy consumption of buildings in London.

Although London Plan policies are in place to reduce carbon emissions (section 5.2 of the London Plan), there is currently no mechanism in place to record and make data available, allowing designers and owners to understand whether carbon emission reductions are realised. This needs both disclosure of energy data and a change in the metric of the energy strategy, so that there is a figure to be verified against.

The Better Buildings Partnership (BBP), has been promoting energy use disclosure for some time through the use of their Better Metering Toolkit[39] and their sustainability benchmarking toolkit. They have also set up The Real Estate Environmental Benchmark (REEB)[40] that can be used to compare the performance of buildings. BBP have also created a Green Lease toolkit to enable owners and occupiers to work together to reduce energy consumption.[41]

NABERS[42] is a national rating system in Australia based on measured energy performance of commercial buildings. It was introduced to create a design-for-performance culture. Since the introduction of NABERS in 2002, new office base buildings in Australia have reduced their energy consumption by 50%.[43]

4.1 London Plan and London Environment Strategy Proposals

4.1.1 New buildings

Energy usage for all new buildings should be disclosed annually in kWh/m^2, broken down by building type in the development, fuel type and by regulated and unregulated use. Energy consumption would be displayed transparently on an online platform along with the predicted energy performance in kWh/m^2 from the energy assessment. This platform can be used to show how developments and buildings are performing.

To make this process as easy as possible, it is recommended that a tool similar to the 'Portfolio Manager tool' used by the US Energy Star programme is used. This tool enables data to be shared by the utility thereby minimising the administrative burden or potential for data entry error.

A requirement for disclosure would be delivered through the Section 106 agreement to include an obligation for the developer and building owner to facilitate the collation of energy data for the first 5 years of occupancy – the length of a section 106 agreement. Once operational reporting is set up for each property, users would hopefully see merit in continuing to provide data and benchmark their performance after the 5-year section 106 period has expired.

A number of organisations have invested in the development of simple energy benchmarking tools including VolDEC[44] by the National Energy Foundation and others.

4.1.2 Existing buildings

- **Data disclosure for all non-domestic buildings**

The GLA currently has no powers to mandate building owners to display the operational energy use of their buildings (e.g. via a Display Energy Certificate, DEC). However, given the overarching importance of London's existing buildings in the achievement of our climate change goals it is recommended that the GLA urge Government to devolve the power to mandate the use of DECs. The data collected from the publication of DECs will provide a good evidence base for the performance of existing buildings, providing the industry with relevant performance data feedback, allowing new buildings to be designed with full feedback and knowledge of current operations. This level of transparency will provide better performance, strengthening the market for more energy efficient buildings.

Within the United States there are over 20 state or city authorities that mandate the use of the Energy Star reporting platform for buildings over a certain size threshold (typically 50-100,000 sqft or commercial space)[45].

To support the case for eventual mandating of energy use disclosure, it is recommended that the GLA develop the tool described in 4.1.1 (for new buildings) so that it can also accommodate information from existing buildings. This tool would demonstrate the practicality of disclosing this information, particularly if it can automatically capture utility data (once customer permission is granted).

In the absence of the ability to mandate disclosure, it is recommended that the GLA actively investigate how it could incentivise the use of a disclosure tool and thereby help to normalise the widespread disclosure of data.

There are many forms of possible incentives that might be considered ranging from acknowledgement (e.g. the right to use a specific branded logo) to other specific benefits or even financial incentives. Where the mechanism for disclosure is straightforward and there is growing availability of data in the market (including that for new buildings), it would be hoped that market forces would encourage disclosure and that the need for additional incentives would be relatively small.

Again, building on the availability of an energy benchmarking tool, the GLA could also investigate the development of an operational stock

model. This might, for example, combine data on buildings from the Valuation Office Agency (VOA) with energy data from utilities. The GLA would need to investigate the most effective way to secure utility data. One option might be providing a simplified approval mechanism whereby the GLA can streamline an approvals process through its existing relationships. A more radical approach might be for the GLA to request access to utility data to enable it to moderate business rates based on energy use intensity.

- **Block level central systems efficiency, carbon intensity and energy cost disclosure for domestic buildings**

Domestic buildings require a different approach. The priority for these developments relates to the performance of the centralised systems or district heating systems connecting the development. Block level data on central systems efficiency, carbon intensity, and energy cost to residents should be disclosed to the GLA and made available for the public.

The measures that are currently being implemented by industry – for example the rolling out of SMART meters – will support the provision of transparency and efficient energy use.

4.2 Detailed Building Performance Data

Incentives should be put in place to disclose enhanced monitoring data. This could be delivered through reduced carbon offset payments for new builds or a reduction in business rates/ council tax, or as a pre-requisite for access to retrofit funding. The detailed data could also be used by the GLA to track how developers are responding to its policies and the impacts on energy consumption and demand patterns.

Examples of detailed data disclosure are below

- Peak demand
- Detailed breakdown of energy use
- Ventilation rate
- Air quality
- Indoor temperature
- Air tightness measured over time

Where there are gaps in information, research should be supported into detailed building performance data. The completion of the agreed research studies should be facilitated through connections with sector experts and academia.

4.3 Incentivising the Energy Efficient Operation of Buildings

The amount of energy used by a building depends on the system that has been specified by the designers, how the systems have been installed and commissioned and maintained and how the occupiers use the building. We need to be rewarding building designers, developers, operators and occupants that reduce actual energy use in buildings.

Currently the GLA and the boroughs have influence over the energy performance of the building at the design stage, when planning permission is sought and can utilise section 106 agreements that can last up to 5 years from when the building is built.

The introduction of data disclosure will give all parties the opportunity and incentive to improve performance. This is through learning about the performance gaps, identifying which systems deliver the energy savings that were expected and through providing a greater trust in the reliability in estimating energy performance of buildings.

The current 'carbon offset' mechanism could be further developed to incentivise actual in-use energy performance reductions by linking the offset payments to verified in-use disclosed energy use; this has been explored by working group 1. The benefit of this approach is that it adapts a mechanism already in place and uses the current powers of the GLA. However, how much energy the building is using is not under direct control of the developer, it is influenced by the building operator and the building tenants. Further work is needed to establish how the responsibility for the energy use, and the offset fee, falls between the developer, building operator and tenants.

Another option is to envision that proposal 4.1.2 has been implemented and energy use data is disclosed for all buildings. Energy use data could then be compared to a benchmark kWh/m^2 that is related to the building type and age of construction. If developments that are designed using the site energy usage targets in proposal 1 end up exceeding the energy use targets that were set, retro-commissioning and / or financial penalties relating to business rates could be enforced.

In any case it is clear that rewards linked to low in-use energy consumption will need to be developed in the future, for both new and existing developments. It must be ensured that any penalties or requirements to improve the energy performance of buildings would need to be phased in appropriately to allow the industry time to learn.

Case Studies

Tokyo, Japaokyo

Large residential buildings must report their energy use under the city's mandatory Tenant Rating and Disclosure Program.[46]

Guangzhou, China

206 large public institutions are required to conduct energy audits and install efficiency upgrades to cut energy use by 20%. [47]

Vilnius, Lithuania

The city has created an interactive online energy map allowing residents to access energy performance data for 4,799 apartment blocks in the city. [48]

Boston, USA

In 2017 Boston's large and medium sized buildings were required to report their annual energy and water use.[49] A city energy map has been developed that tracks hourly energy use of 85,000 buildings. [50]

Other Strategic Objectives

GLA to Support Education Programs

It is proposed that the GLA should facilitate a programme to provide support to building owners and occupiers. Such a programme would provide information and methods of energy saving and energy consumption disclosure. Themes to include:

- Effective metering strategies and allocation of responsibility for energy use
- Energy management and identification of energy efficiency opportunities
- Lease and Memorandum of Understanding templates to assist landlords and occupiers collaborate effectively on energy and other aspects of building performance
- Tools for estimating and disclosing energy performance, leading to tools to support benchmarking and target setting

GLA to Lobby the Government

We advise the GLA to lobby the government on the following issues:

- Building regulations

The government should update the carbon emission factors in building regulations.

- Reducing the carbon emissions of existing buildings

The government should devolve greater powers to the Mayor around building energy efficiency, so that the GLA has the power to introduce mandatory energy audits and retro-commissioning for poorly performing existing buildings.

To address the need to provide incentives to retrofit existing buildings, working group 3 proposed that a minimum Energy Performance Certificate (EPC) rating of B shall be required by new lease agreements for existing buildings, in order to incentivise the improvement in energy performance of the existing building stock. See working group 3 report for more information. It was agreed by the LETI task force that this is an ambition to be worked towards in the future, progressing from F to B over an agreed period. This would require further powers to be devolved to the Mayor.

GLA to Support Retrofitting

A programme of retrofitting existing building stock is another key driver required as part of the route map to a Zero Carbon London. The GLA and Local Authorities should put in place a programme of retrofitting a set percentage of building stock every year to facilitate this. This would build on the existing RE: FIT programme.

The GLA needs to clarify its approach to major domestic and non-domestic refurbishments and whether major refurbishment projects should be designed to meet Part L new build requirements.

Bringing It All Together

Draft London Environment Strategy - Energy Hierarchy

The draft London Environment Strategy proposes to update the current wording of the energy hierarchy to the wording below.

1. Be Lean:

use less energy and manage demand during construction and operation

2. Be Clean:

exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly

3. Be Green:

generate, store and use renewable energy onsite

LETI - Energy Hierarchy

The LETI proposals outlined in this paper support this hierarchy, but it is proposed that it is delivered a different way. Rather than showing the percentage carbon emissions reductions compared to the notional building, it is proposed that developments show compliance using the metrics outlined in the report, as shown below. It is also proposed to include a 4th stage to the hierarchy; 'Be Seen'.

Be Lean

- Compliance with the fabric efficiency target

Be Clean

- Compliance with kWh/m^2 energy use target
- Follow the 'delivering low carbon heat' hierarchy
- Display peak reduction

Be Green

- Compliance with onsite renewable energy generation target

Be Seen

- New developments to publicly disclose their actual energy and carbon performance for 5 years

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Appendix

Working Group 1:

Data Disclosure

Working Group Leader - Adam Mactavish

1.0 Scope of the working group

Disclosure of information on a building's energy use is a central component underpinning progress in reducing its carbon emissions and running costs. Disclosure brings many benefits, including:

- **Clear information on the real performance of buildings, thereby incentivising building providers (developers and landlords) to seek the best possible real performance rather than modelled compliance with regulations.**
- **Enhanced understanding on the way in which buildings use energy enabling policy makers, designers and building managers to achieve better outcomes from their work.**

In common with most of the UK, there is currently very little disclosure of property specific data on the energy consumption of buildings in London.

The working group sought to identify practical and effective means by which the GLA could work to increase the disclosure of energy data to refocus attention on actual performance and on the actions that reduce energy use in practice. Currently the Mayor does not have the power to mandate the disclosure of energy data for an existing building, but there are still opportunities to encourage disclosure through effective design of policies for new buildings and by creatively utilising the Mayor's power to incentivise and recognise good practice. The group comprised architects, engineers, energy consultants, energy managers, investors and academics. It met once to identify priority recommendations, with further correspondence via email.

Working group members

Joe Jack Williams - Fielden Clegg Bradley
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Robert Cohen - Verco
Malcolm Hanna - National Energy Foundation
Phil Draper- Broadgate Estates
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2.0 Key Challenges

In the UK, we spend ~£5Bn each year on new construction yet have very little good data on how building regulations impact actual energy performance. This information gap also applies to energy policies in the London Plan. In 2015, the London Plan's energy policies were projected to save 49,000 tonnes of CO_2e per year from c.£150M invested in low carbon infrastructure and technology[1]. However, we have no information on the actual energy or carbon saving achieved and so cannot say whether the £150M has been well spent.

Major landlords are already actively measuring and reporting the energy consumption of their portfolios through, for example, the Better Buildings Partnership or the Global Real Estate Sustainability Benchmark. However, information on individual buildings is not widely disclosed.

Studies of the actual performance of new buildings highlight a significant gap between the energy modelled during design and that measured in use, averaging 2.8 times higher in homes[2] and 3.8 times higher in non-domestic buildings[3]. Part of this discrepancy is a result of the omission of 'unregulated' energy in most energy modelling. However, a large part of the gap is the result of buildings being designed to achieve better theoretical performance, not better actual performance, and frequently in the failure to effectively commission and operate a building to its potential. The problem is particularly acute for air-conditioned buildings because the compliance regime does not require scrutiny of how HVAC systems and their controls will perform in operation. A well-maintained evidence base on buildings' actual energy use could ensure focus and investment is directed to where it can deliver most benefit.

Beyond a lack of knowledge to inform policy development and the resulting design decisions and expenditure, failure to disclose energy data risks limiting the market for energy efficient buildings. This is because an absence of reliable and comparable information on actual performance limits the ability of occupiers or investors to take energy performance into account when making decisions.

If developers and building owners knew that the energy performance of their buildings would be transparently available they would have a strong incentive to take steps to improve its efficiency. For example, by refocusing design, specification and management decisions around the actions needed to achieve energy efficiency in practice. This new focus on actual building performance would give building professionals the licence to invest in and use tools more accurately to predict actual energy performance, while also ensuring that sufficient emphasis is placed on building quality, commissioning and handover and in supporting its users and managers.

The London property market is complicated, not least in the roles and responsibilities of landlords and occupiers, both of whom have substantial responsibility over different elements of a buildings energy use. Currently, it is often the case that these different parties fail to communicate and collaborate effectively to improve building performance (including energy). The progressive introduction of data disclosure would give each party an incentive to improve their combined performance and would encourage the introduction of new arrangements to their joint advantage.

Where energy data disclosure programmes have been implemented internationally there is a strong correlation with improved building performance[4]. For example, in New York between 2010 and 2013, buildings participating in a benchmarking programme achieved energy savings of c.6% resulting in annual energy savings worth over $260M. Across the US, analysis of 35,000 benchmarked buildings showed energy savings of 7% over three years. Perhaps the best-known building rating initiative is the Australian NABERS scheme which has been shown to drive progressive improvements in both energy performance with reduced operating costs and higher returns to the building owners.

Put simply, energy data disclosure could trigger a change in mindset from compliance to excellence, rewarding those able to provide energy efficient space, while increasing the availability of high quality well managed buildings for London's businesses.

Recommendations

A. Mandate annual public disclosure of actual energy use by new developments over 1,000 m^2 GIA during their first five years of operation.
B. Commission an online platform which can support energy performance disclosure by new developments.
C. Seek additional powers to mandate disclosure of energy data for existing commercial buildings over 1,000 m^2 GIA.
D. Examine creatively how it can encourage or incentivise existing buildings to disclose their energy performance through the online platform.
E. Explore options to capitalise on existing data on building floor area, sectoral activities and actual energy use to automate energy performance disclosure and benchmarking.
F. Require that carbon offset payments for new buildings calculated at the design stage are adjusted according to the verified in use energy consumption in operation.

3.0 Policy Input Recommendations

Two outcomes are desired from data disclosure, each requires a different approach:

1. Greater **transparency** of overall building performance for all buildings - to encourage better performance and strengthen the market for efficient buildings.
2. Better **understanding** of the detailed performance of different building types - to enable and encourage operators, designers and policy makers to make better decisions (partially in response to the greater transparency of performance).

In return for the above disclosure, the GLA should offer support to landlords to assist them in improving performance, this could prove to be one of the best value uses of carbon offset payments.

Transparency

1 | Energy usage for all new buildings to be disclosed annually in kWh/m^2, broken down by building type in the development, fuel type, and by regulated and unregulated use

Energy consumption would be displayed transparently on an online platform along with the predicted energy performance in kWh/m^2 by fuel type from the energy assessment. This platform can then be used to show how developments and buildings are performing. A requirement for disclosure would be delivered through the Section 106 agreement which would include an obligation for the developer and building owner to facilitate the collation of energy data for the first 5 years of occupancy – the length of a section 106 agreement. Once operational reporting is set up for each property it would be hoped that users would see merit in continuing to provide data and benchmark their performance after the 5-year S106 period has expired.

To make this process as easy as possible, it is recommended that the section 106 agreement places an obligation on all new development owners to require their energy suppliers to upload at least monthly data (as measured by the development's utility meters) to the online platform. A comparable process is in place in several US States, such as California, which take advantage of the US Energy Star 'Portfolio Manager' online platform.

2 | The Mayor should seek powers to mandate the disclosure of energy performance for existing buildings

The GLA currently has no powers to mandate building owners to display the operational energy use of their buildings (eg via a Display Energy Certificate). However, given the overarching importance of London's existing buildings in the achievement of our climate change goals it is recommended that the GLA urge Government to devolve the power to mandate the use of DECs. The data collected from the publication of DECs will provide a good evidence base for the performance of existing buildings, providing the industry with relevant performance data, and allowing new buildings to be designed with full feedback and knowledge of current operations.

This level of transparency will strengthen the market for more energy efficient buildings. Within the United States there are very many (over 20) state or city authorities that mandate the use of the Energy Star reporting platform for buildings over a certain size threshold (typically 50-100,000 sqft of commercial space)[5].

3 | To support the case for eventual mandating of energy use disclosure, the GLA should develop the tool described for new buildings so that it can also accommodate information from existing buildings

This platform, particularly if it can automatically capture utility data (once customer permission is granted), would demonstrate the practicality of disclosing this information and reduce barriers to disclosure. Further, once new buildings have begun the process of reporting their energy use (see recommendation 1) then it would be hoped that they would not opt out of ongoing reporting and the growing number of reporting buildings might encourage their peers to participate in the system.

4 | In the absence of the ability to mandate disclosure, the GLA should actively investigate how it could incentivise the use of a reporting tool and thereby help to normalise the widespread disclosure of data

There are many forms of possible encouragement or incentives that might be considered or creatively developed, ranging from acknowledgement (e.g. the right to use a specific branded logo) through to other specific benefits or even financial incentives. Where the mechanism for disclosure is straightforward and there is growing availability of data in the market (including that for new buildings), it would be hoped that market forces would encourage disclosure and that the need for additional incentives would be relatively small.

5 | Consider the development of an automatic operational energy use model

An automated energy benchmarking tool might, for example, combine floor area and activity data on buildings from the VOA with energy data from utilities. The GLA would need to investigate creatively the most effective way to secure utility data. One option might be providing a simplified approval mechanism whereby the GLA can streamline an approvals process through its existing relationships. The GLA might also look at how access to energy supply data could underpin its potential role in supporting London's businesses to have secure energy supplies and in supporting London's buildings to take part in demand response and contribute to the optimum, smooth and safe operation of the various energy systems and district infrastructures to which they are connected. Another approach might be for the GLA to request access to utility data, for example, to enable it to moderate business rates based on energy use intensity. Building on the availability of an automated energy benchmarking tool, the GLA could also investigate the development of an operational energy stock model for the whole of London.

6 | Block level data on plant efficiency, carbon intensity and cost should be disclosed for multi-family apartment blocks and heat networks

For existing domestic buildings, the priority would be the performance of developments with district heating or other centralised systems. For these buildings, it is recommended that block level data on central plant efficiency, its carbon intensity and cost is disclosed to GLA and made available to residents.

Other existing homes in London are less of a priority in relation to this strategy as it is hoped that SMART meter roll-out and associated commercial services would help to provide visibility of energy consumption to help encourage efficient energy use.

7 | Carbon offset payments for new buildings should be based on their verified in use energy consumption

For new buildings, a further incentive for better operational performance is recommended. One option is for GLA to join up their new policies for London with the BREEAM New Construction Verification Stage proposed for 2018[6], and alternative approaches are also developing. This approach would have multiple benefits including:

- Requiring disclosure of performance data against which design stage estimates can be assessed, this will help all parties to make more informed and better decisions.
- Encouraging developers to consider eventual performance rather than just compliance with design standards may change their approaches and increase levels of quality assurance.
- Incentivising the effective commissioning and operation of the building from the outset.

Various options are possible for payment of an offset based on the measured performance of regulated energy uses, including:

- Making a higher offset payment for 30 years use at the design stage based on an assumed performance gap, and then a single rebate / further payment after year 1 of >80% occupation if the actual impact is higher or lower.
- Making a payment for design stage regulated impact for 30 years use (as currently) with additional payments in each year of subsequent operation based on the actual (measured) impacts of the regulated loads above this predicted base (thereby incentivising improved energy management over time).

A stronger step would be to relate the current carbon offset payment to total operational energy use rather than the Part L calculation of regulated energy use under standard conditions. This would have the significant advantage of not requiring any extra measurements beyond the DEC or equivalent that a larger new building would require once it was in operation (recommendation 1). The group also considered that if it was right for new buildings to be asked to pay a carbon offset, in effect a license fee to add a new source of carbon emissions to London's baseline, then it was logical for such a fee to be based on the building's total emissions not some harder-to-meter sub-set related to the efficiency of the building's fabric and plant, which excludes the emissions arising from the activities of occupiers. With this approach, the options for payment of the offset include:

- Making a higher offset payment for 30 years use at the design stage based on an assumed performance gap PLUS unregulated energy use, and then a single rebate / further payment after year 1 of >80% occupation if the actual impact is higher or lower.
- Making a payment for design stage regulated impact for 30 years use (as currently) with additional payments in each year of subsequent operation based on total actual impacts above this base (thereby incentivising improved energy management over time).

Increasing the scope of the offset payment and / or the period over which it is paid would necessitate landlords and their occupiers working together to determine how they can minimise energy use and allocate costs effectively.

Established models are in operation to enable allocation of energy use between occupiers and landlords. These could be more widely applied in new buildings, providing a further return on the investment in their sub-metering and an incentive to ensure that the metering is correctly commissioned.

Although this option delivers significant benefits over an offset payment based on modelled regulated energy only, it is recognised that it would be a disruptive policy impacting the nature of relationships between developers, building owners and occupiers. Further, there could be practical challenges in recovering offset monies after the building is complete and, perhaps, has been sold. Nonetheless, the current situation whereby buildings are not achieving their potential is such that the GLA should aim to move to position where there is a closer link between the real emissions associated with a new project and the associated offset payment.

Understanding

It is also important to gather more detailed data on energy use in different buildings, to understand the breakdown of energy use by load and actual in use performance factors for different services, etc.

8 | Incentives should be offered for disclosure of detailed energy data, for example through reduced carbon offset payments and/or as a prerequisite for access to energy support

It is expected that any discount in offset payment would not need to be significant to prompt detailed data disclosure, but would encourage the relatively rapid accumulation of much more detailed data on in use energy for new buildings. The detailed data could also be used by GLA to track how developers are responding to their policies and the impacts on energy consumption and demand patterns. Such data could be valuable in helping to better predict the impact of future development on the London energy system.

9 | A limited portion of carbon offset revenues should be used each year for the analysis of detailed building performance data targeting key gaps in existing data

The detailed format of energy / carbon data to be provided was not discussed. Although models exist from Innovate UK's Building Performance Evaluation Programme (2010-2014).

Support

Many energy efficiency measures are among the most cost effective and rapid means of reducing carbon emissions and could therefore be suitable for expenditure of revenue from carbon offset payments.

10 | A programme of targeted support should be available to help building owners and occupiers to disclose and save energy

Support may also be needed to help the market respond to the impacts of increased disclosure. The GLA / boroughs could usefully provide targeted support mechanisms for market actors to assist the real estate sector in:

- Effective metering and allocation of responsibilities for energy use
- Energy management and identification of energy efficiency opportunities
- Lease / MoU templates that might be used to help landlords and occupiers collaborate effectively on energy and other aspects of building performance.
- Tools for efficiently estimating and / or disclosing energy performance together with training on their use

The Better Buildings Partnership and others have produced a wealth of guidance resources that could be used for these purposes. CIBSE Low Carbon Consultants are an example of skills and expertise human resources available to the property industry which might need to be broadened and deepened.

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Working Group 2:

New Performance Metrics For Better Outcomes

Working Group Leader - Thomas Lefevre

1.0 Scope of the working group

The scope of working group 2 was to discuss whether the current compliance metrics in the London Plan were fit for purpose or whether they are hindering the design and delivery of better performing buildings with lower CO_2 emissions. Members of the working group are architects, contractors, academics, engineers and energy specialists. We had two workshops to share our opinions and experiences and structure our recommendations.

The aim of this paper is to communicate to the Greater London Authority these key recommendations. Further work is required to refine them but they reflect the opinion of the working group as a whole. They should be read in conjunction with the recommendations of the working groups on data disclosure and decarbonised heat & energy.

Working group members

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2.0 Key Challenges

London needs to reduce its CO_2 emissions by at least 80% by 2050 compared to 1990 levels[1]. This means reducing CO_2 emissions associated with buildings (new and existing) to nearly zero[2]. The challenge is significant but it is not too late. It also seems more achievable when it is broken down into the three areas of action recommended by the Committee on Climate Change: **Reducing energy demand**, decarbonising heat and decarbonising electricity.

The latest C40 cities publication 'Deadline 2020'[3] reports the efforts made to date by the largest cities in the world to curb their carbon emissions and most importantly those required in the (immediate) future. The name of the report and its main objective are to highlight that emissions should be set on the right tracks by 2020 in order to achieve the 2050 objectives. Unfortunately, London is not on the right track[4]. The current performance metrics are part of the problem, as already identified by industry consultation in a 2015 report commissioned by the GLA[5]. Among other issues:

- Planning and design carbon metrics cannot be measured once a building is in operation, which makes it impossible to quantify the impact of planning policy, at a building scale or London-wide.
- The current planning targets based on using Part L compliance tools encourage a culture of false reporting and do not lead to best practice design and performance.
- The performance gap is an issue across all stages of design, construction and operation.

This working group has developed recommendations to tackle these. We acknowledge that in order to design and build better buildings which are truly energy efficient and low/zero carbon a step change is required. Although the planning system cannot solve all problems, we believe that a significant number of decisions are made and directions set pre-planning. Therefore, there is a lot which can be done through the London Plan to accelerate the delivery of low/zero carbon buildings. We now need to focus on outcomes which are clear, transparent and can accompany a building from concept design to construction through to operation.

Better buildings are possible. First and foremost, these buildings will be fit for purpose, comfortable, healthy, resilient and affordable to run. They will have a reduced energy demand through much improved fabric energy efficiency, reduced energy wastage[6], access to a low carbon heating system, the ability to generate zero carbon electricity, and they will manage/store energy better. In addition to reducing the energy use and carbon emissions of the buildings themselves, this comprehensive set of measures will also support further decarbonisation of the electricity grid.

Recommendations

1. London needs better performance metrics
2. A kWh/m^2 target for a better outcome
3. Fabric energy efficiency is a priority
4. CO_2 matters
5. Beyond energy and carbon: better buildings for Londoners

3.0 Policy Input Recommendations

Recommendation 1 | London needs better performance metrics

We are in favour of metrics based on actual performance in operation to help us deliver better buildings. Focusing on a metric which can be adopted from day one, checked throughout design/construction and then verified during operation would help us to go much further on the journey towards a better understanding and delivery of energy efficient buildings. It would help avoid the limitations associated with a single Part L metric which does not correlate to any operational targets, tends to be relevant mainly during the design phase and cannot be used to report against actual carbon reduction targets at a borough level. Tying up design, construction and operation is a significant advantage of this approach, along with the ability to require a specific level of energy performance. The zero carbon target often hides a variety of approaches and levels of ambitions. **Our recommendation is therefore for the GLA to stop using Part L based targets and adopt a better performance metric.**

The most successful and efficient energy standards are all based on clear, transparent and absolute performance metrics[7]: Passivhaus, AECB Silver, NABERS[8], DEC A rating performance contracts, Better Buildings Partnership Landlord Energy Rating[9]. These standards lead to energy use which can be up to 3 times lower. They could be rewarded, if not mandated. A number of London boroughs are already putting a particular focus on performance[10].

Recommendation 2 | A kWh/m^2 target for a better outcome

Keeping things simple and transparent is very important. A 'kWh/m^2 (energy use) metric' has the advantage of being a very basic metric which can easily be compared against post occupancy surveys of comparable buildings[11] during the briefing stage, be evaluated during the design, be checked during operation and be translated into both carbon and financial costs and savings throughout the process[12]. In the context of the current and future decarbonisation of the grid, it also helps to make it independent from this effect and therefore simplify the monitoring and comparison during the lifetime of a building and its design/construction.

The whole working group was unanimous in agreeing that Part L assessments are not sufficient to design and deliver low carbon buildings. The current Part L process can sometimes act against best practice design and lead to worse outcomes. **We recommend focusing on energy performance and using 'kWh/m^2' as the metric.** This would require evolving the current energy modelling approach towards better energy assessment / performance modelling. However, methodologies and tools are available (e.g. CIBSE TM54, PHPP) and better energy modelling is essential to ensure that design and construction choices are well informed.

A more challenging question is how ambitious these energy targets ought to be for various building types as a similar approach to the 'one size fits all' 35% improvement over Part L 2013' target could not apply. The GLA should set specific and ambitious levels of performance based on published performance data[13] for new buildings and major refurbishments and update them annually[14]. This would help to gradually educate the project teams about 'actual energy performance' and build over time a culture of energy performance and disclosure/transparency in the industry, and develop the associated skills, jobs and products. Finally, a 'kWh/m^2' indicator measured consistently at each stage and during operation (associated with a mandatory disclosure of data – refer to recommendations from Working Group 1) would be very helpful at identifying the most successful approaches and eradicate over time the most damaging.

Recommendation 3 | Fabric energy efficiency is a priority

There is a growing consensus that the building fabric represents a significant and essential opportunity to save energy and carbon for the lifetime of a building and improve its resilience. The risk of 'locking in' inefficiency/high emissions is also much higher with the building fabric than its services and 'getting it right' is much less challenging than 'fixing it' later. LPAs also have more control over this aspect than heat and electricity decarbonisation.

A growing number of projects currently adopt a 'fabric first approach' following the same principles and quality assurance methodology as Passivhaus, without necessarily achieving the Passivhaus level of performance. Additional guidance on what 'fabric first' actually means and which level of quality assurance would be necessary to ensure that it is delivered could also be beneficial.

We would recommend introducing a 'Fabric energy efficiency metric' and its associated target(s) to push the 'be lean' step of the energy hierarchy as much as possible and gradually shift projects from business as usual to good and best practice without leading to unintended consequences (e.g. overheating). The GLA should review and analyse the merits of several examples of fabric energy efficiency metrics, including:

- The 'Fabric Energy Efficiency Standard' metric calculated by SAP with enhanced and absolute levels of performance as per the Zero Carbon Hub's definition of 'Zero Carbon'[15]: It was introduced to ensure that zero carbon homes have an energy efficient building fabric. 'Full' and 'interim' performance levels have already been adopted in key areas in London[16].
- The space heating/cooling demand assessed by PHPP (15kWh/m^2 for Passivhaus, 40kWh/m^2 for AECB Silver) is also a very effective fabric energy efficiency metric.
- A resilience target with the building having to maintain certain temperature conditions for a period of time with no electricity or heat input, both in summer and winter. This is by proxy an energy efficiency target. The ability of the fabric to reduce peak demand (heat/electricity) is also likely to become more important in the future.

Recommendation 4 | CO_2 matters

Climate change mitigation requires carbon emission reductions and therefore carbon needs to be reported. For this reason, a carbon budget is being set at a national level and we are likely to see carbon budgets and predictions being set at a more local level in the near future[17]. A carbon metric would make it easier to correlate the strategic efforts and the performance achieved by a particular building. **We recommend that carbon emissions are reported accurately but we do not think that carbon should be the key performance driver.**

There is also an issue with the way CO_2 emissions are currently calculated in the context of rapid electricity grid decarbonisation. The latest official estimate of carbon intensity of the UK electricity grid (254 gCO_2/kWh[18]) is more than half the value used within Part L (519 gCO_2/kWh). This could be addressed by the GLA publishing guidance on carbon factors on a regular basis (at least every 2-3 years) based on published data[19]. There is also an argument for the

use of a variable electricity carbon factor[20]. A consistent calculation methodology is critical.

In summary, we are in favour of requiring applicants to predict the estimated operational CO_2 emissions of the building with the energy target as the key performance metric. Reporting of actual total carbon emissions (pre- and post-planning as well as during operation) should also be mandated to make it easier for local authorities to track progress against their climate change targets.

Recommendation 5 | Beyond energy and carbon: better buildings for Londoners

Recommendations 1-4 focus on energy performance and carbon reduction. However, we all acknowledge that these necessary ambitions should not come at the expense of people: health, comfort[21], quality, maintenance are all very important dimensions[22]. **The Greater London Authority, together with the building industry, needs to continue to develop performance metrics and require designers, developers and contractors to start reporting against these parameters to build a database of performance against which future targets could be set.**

As far as fuel poverty and/or more generally the affordability of heat and energy are concerned, we would recommend that the GLA undertakes research on how future energy bills can be quantified[23] [24]at an early stage to ensure that lower carbon solutions do not lead to unaffordable energy bills and therefore colder homes.

Indoor air quality and its link to ventilation and airtightness should also be better monitored. There is much evidence that low-carbon and very low energy buildings can deliver similar, and even better indoor air quality and comfort[25], but this relies on good design and implementation.

And also…

This working group could have decided to cover other metrics (e.g. embodied carbon[26], energy storage, peak shaving, etc.) but agreed that the areas covered by our five recommendations are the most critical and hence should be focused on as a priority.

More work for everyone, but no effect on viability

We acknowledge that implementing these recommendations will require more work from the applicants, the GLA and the LPAs. However, applicants often highlight the risks and costs associated with inconsistent approaches and an unfair and uncertain playing field, which do not reward the best energy and carbon reduction strategies. We think a clear trajectory and transparent targets would be welcome. We therefore do not believe that our recommendations would affect viability and, most importantly, we think that it is the right approach to set London on the right tracks to achieve its carbon reduction targets. We cannot effect change without effort.

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8. NABERS - www.nabers.gov.au
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10. Green Performance Plan required by the London Borough of Islington
11.Building Performance Evaluation, Innovate UK – an improvement of published performance should be sought
12. Setting a 'kWh/m2' as a single 'primary energy' figure is possible and has its merits. However, the conversions required (and the associated conversion factors) could introduce a level of unhelpful complexity, and ultimately be subject to the same compromises and limitations as carbon factors.
13. Building Data Exchange, Carbon Buzz, DECs, etc.
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15. Zero carbon homes and nearly zero energy buildings, Zero Carbon Hub (2014)
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18. DUKES (2017)
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Working Group 3:

Decarbonising Energy & Heat
Working Group Leader - Amanda Stevenson

1.0 Scope of the Working Group

Significant progress has been made to decarbonise the electricity grid. However, the gas grid has not been as quick to adopt low carbon sources. Current planning policy and building regulations are not reflective of these changes in nationwide infrastructure and are not supporting the need for differing approaches to adopting appropriate technologies and innovation.

Existing homes and workplaces account for 78% of carbon dioxide emissions in London and, with 80% of these buildings expected to be in operation in 2050, it is vital that steps are taken to adapt existing buildings using fossil fuels to building using low and ultimately zero carbon technologies, in order to achieve the long-term goal of significantly reducing carbon emissions. [1]

Current planning policy is considered as restrictive, for example the prevalent, sometimes enforced, application of CHP, is potentially tying buildings into relatively poor long-term carbon performance from the outset of operation and is stifling the opportunity for incorporating engineering strategies that are appropriate to the building use, the scale of a project and future developments.

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2.0 Key Challenges

- Current prescriptive methods of demonstrating policy compliance lead to a design vs. operation performance gap (e.g. legacy carbon factors, rigidity of modelling software, tick-box exercise for heat networks).
- It is expected that as London continues to grow and energy demand increases, there will be a greater need for decentralised energy storage capacity (both electric and thermal) and demand response including 'peak shaving measures', however this isn't currently explicit in policy or incentivised.
- Current approach to offsetting carbon emissions is not robust or clear enough and is ring-fencing emission reduction projects to within London. It is argued that this lack of clarity suppresses meaningful implementation.
- Current energy policy doesn't incentivise building operators to share operational energy performance to support continual improvement in design.
- Building regulations represent minimum standards; by linking policy to building regulations can lead a performance gap and does not incentivise higher performing buildings.
- End-user costs associated with district heating provisions are unregulated and the benefits associated with the decentralised approach are not frequently shared.
- District heating standards currently often restrict end-users from using solar hot water or energy efficiency measures to reduce their demand and bills through high standing charges or clauses. Often users are also not allowed to disconnect from the network irrespective of DHN heating costs.
- Strategies to capture waste heat are not being fully considered within design. Greater policy direction is needed to drive identification of capturing waste heat including life cycle cost.
- Current policy guidance (e.g. GLA Energy Planning) recommends ways to provide robust evidence for demonstrating technical and financial feasibility. However, high-quality evidence is disregarded if the conclusion does not align with policy priorities to deliver an arguably superseded strategic agenda.
- There is a growing demand for cooling, particularly in homes in London and how this will be provided should be considered.
- Air pollution is not adequately considered in assessments for decarbonising heat.
- The capital cost of energy efficiency and renewable generation measures are commonly paid by a different group to the end user of the energy, so that capital cost is not linked to the consequent savings in running costs (e.g. housing agency and tenants). This does not incentivise capital spending or ensuring that actual performance matches predictions. A linkage method could also enable external investment energy retrofits, unlocking capital from major investors like banks.
- A greater emphasis on energy-efficient design is leading to buildings with lower energy and heating demands. This shift in demand should be considered more holistically alongside issues such as overheating.

Recommendations

1. All new developments to be Net Zero Energy
2. A minimum EPC of B for existing buildings where new leases are agreed
3. Heat Network Development
4. Use of fossil fuels
5. Impact on infrastructure
6. Carbon factor

2.0 Priorities

- Set aspirational stretch performance targets and let industry respond.
- Encourage innovation and be technology and distribution neutral.
- Create a transparent, credible and realistic approach to demonstrate meeting of performance targets (for example TM54 for analysing operational energy use, recognised techno-economic optimisation software, BCIS Standardised Method of Life Cycle Costing, etc.).
- Give equal importance to technical, economic and commercial models for short and long term feasibility of energy solutions.

- Policy to reward:
  - » In-use performance and link end users with design to enhance financial viability of zero carbon buildings
  - » Reduction of impact on infrastructure to reduce need for extra network capacity
  - » Use of positive demand management to increase resilience and support wider uptake of renewables
  - » Sharing of performance data

- Greater clarity of heat network provisions that considers;
  - » Removal of requirement for new developments to connect to or create a heat network
  - » An end to any gas-fired CHP-led networks
  - » Long-term investment intentions
  - » Design quality
  - » Decarbonisation potential (over a building's lifecycle)
  - » Sharing of waste heat
  - » End users should be better informed of implications of supply from heat network and if possible, freedom for end user to switch systems

- Greater clarity of electrical network provisions, specifically:
  - » Local infrastructural pinch points
  - » Local high demand users / opportunities for sharing
  - » Grid capacity (to limit rise in grid voltage)
  - » Local battery storage capacity

3.0 Policy Input Recommendations

Recommendation 1 | All new developments to be Net Zero Energy

- Base assumption that all new buildings are net zero energy (NZE). (We recognise that NZE in London may not be initially feasible, therefore the offsetting of any deficit by developing renewable sources of energy outside London may become a widely adopted approach.) Where possible, heating should not be provided from fossil fuels (either through boilers or CHP).

Recommendation 2 | A route map for existing buildings to achieve a minimum EPC rating of B where new leases are agreed

- In order to incentivise the improvement of the energy performance of existing building stock a route map should be established that sets a trajectory for requiring a minimum EPC B rating for existing buildings where new leases are agreed. Recognising the importance of London's listed buildings, where it is not possible to improve the energy performance of listed buildings to the minimum EPC standard, it will be possible to offset the differential between the target and the actual EPC with off-site renewable sources.

Recommendation 3 | Heat Network Development

- Where a heat network is proposed, it must be demonstrated that the cost to the end user is no more than national pricing or an agreed pricing index. Performance efficiency and actual carbon factors must be reported annually and costs must include operation and maintenance of the heat network.

- Where a heat network is proposed that will distribute high-grade heat (greater than 50^{0}C), it shall be required to demonstrate how the network and buildings served will transition to a low-grade heat approach.

- The use of heat rejection equipment to be de-incentivised and only permissible where it can be shown that there are no users within a 10-year period. It follows that the use of heat pumps to provide heat and coolth while coupled with low-grade heat networks should be incentivised.

Recommendation 4 | Fossil Fuel Free

- In order to improve air quality and reduce dependence on fossil fuels all new developments should be combustion free, with no negative impact on local air quality.
- Where combustion is required for a specific use, e.g. high hot water demand, the developer shall be required to demonstrate how the building will transition to a combustion-free approach, for example demonstrating that heating can be met by low-grade heat sources.
- It may be viable to restrict gas usage for domestic hot water usage only.
- Tighten air quality targets.

Recommendation 5 | Incentivise Smart Demand-Response Measures

Incentives to incorporate smart demand-response measures (and on-site storage where feasible) and to lessen the extent of infrastructure required to encourage longer-term thinking on the draws upon national infrastructure.

Recommendation 6 | Support Innovation

- In order to promote innovation, technological approaches to achieve compliance are to be agnostic with industry producing more rigorous and adaptable compliance and analysis tools, e.g. CIBSE, BRE, BCIS etc. These tools should allow flexibility for designers to demonstrate compliance and economic feasibility for a wide range of technologies that can be appropriately assessed by the relevant authority, while also supporting design vs. operational analysis.
- Policy to incentivise the actual performance of a building meeting that predicted at planning stages. (DEC vs design EPC – financial penalties)

Recommendation 7 | Evaluate Carbon Factors

- Provide agreed carbon factors that are regularly reviewed (e.g. every 2 years) to recognise decarbonisation and for a fair benchmark to promote design innovation in buildings and new neighbourhoods. It is recognised that Part L does not encourage innovative design due to emission factors that are out of date, therefore the policy of having regularly reviewed updated carbon factors will address this shortcoming.
- Provide agreed future carbon factors that are regularly reviewed to recognise decarbonisation at a later stage in the building life cycle and promote design innovation in buildings and new neighbourhoods.

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Working Group 4:

Delivery Mechanisms
Working Group Leader - Stephen Kent

1.0 Scope of the working group

In the draft London Environment Strategy[1], the Mayor has reaffirmed London's position as being a lead in tackling climate change, setting a zero-carbon target for London by 2050. The Mayor has stated that London will require economy-wide decarbonisation with energy infrastructure that is diverse low carbon and local, a grid that is smarter able to balance energy demand with homes and workplaces that are highly insulated and energy efficient.

The purpose of working group 4 is to produce evidence based recommendations for delivering energy policy that strives towards a zero-carbon future for London but remains technology neutral and flexible enough to drive innovation.

This working group is a cross sector effort made up of architects, engineers, developers, energy specialists and local authority policy makers. The recommendations proposed in this section have been developed from 3 workshops and correspondence with the GLA. Further investigation is needed to refine them but the intent and the potential benefits are there, indicating how London can become the zero-carbon capital it intends to be.

Working group members

Debbie Hobbs – Legal & General
Hero Bennett – Max Fordham
Joe Baker – Haringey Council
Chris Twinn – Twinn Sustainability Innovation
Michael Severn – Linkcity
Olivier Boennec – Elementa Consulting
Richard Twinn – UKGBC
Syed Ahmed – Energy for London

2.0 Key Challenges

London's current approach to energy policy is prescriptive, focusing unduly on the 'Be Clean' aspect of the Energy Strategy. Developers and their design teams are encouraged to focus upon the methods for achieving policy compliance rather than seeking to deliver tangible reduced energy demands. Furthermore, under the current system, there is no responsibility on anyone to save energy, instead only to demonstrate a compliance method. Using this current compliance method that does not relate to final measured energy use has encouraged the Performance Gap. If London is to reduce its GHG emissions from 38 megatons to zero carbon by 2050 this must change. As outlined previously by Working Group 2 and the Committee on Climate Change, London energy policy needs a greater level of flexibility aimed at supporting innovation to first and foremost reduce energy demand for both new and existing buildings as then on decarbonising the supply of heat and electricity.

London's energy policy does not consider the carbon emissions associated with unregulated energy and only focuses upon the regulated emissions. If this was to continue London would not be net zero carbon by 2050. Similarly, it allows climate resilience to become a future additional energy liability. These worsen the performance gap and lead to greater insecurity and instability for London's future energy infrastructure. The carbon offsetting fund in its current format is also a barrier to London's Zero Carbon aspirations. A report by the GLA in 2016 found that of the 22 LPAs who collect carbon offsetting funds only 7 have used the funds citing S106 complications and a lack of identified projects to make use of the offset funding[2].

In summary, the issues are:

- Prescriptive energy policy stifling building demand reduction innovation.
- The performance gap is not being addressed with unregulated emissions being neglected.
- The carbon offsetting fund is not being utilised to its full potential. A lack of transparency exists and funds are not being used.

This working group has drawn on a considerable experience base to develop recommendations to address these issues. Further investigations are anticipated to quantify both the metrics and the implementation timing of the step change required.

A net zero carbon London is possible. To deliver this, the policy mechanisms need to be fit for purpose, encouraging demand reduction innovation, reducing the performance gap and leading to tangible benefits. London's buildings will have a reduced energy demand, greater energy efficiency and thermal performance. London's grid will be low carbon, diverse and smarter.

Recommendations

1. A more informed energy strategy - a kWh/m^2/yr metric alongside climate resilience adaptability
2. A supportive long term vision for district energy networks
3. A carbon offsetting fund that transparently saves carbon
4. Work towards measured whole building based policies

3.0 Policy Input Recommendations

Recommendation 1 | A more informed energy strategy

Proposal: A kWh/m²/yr target that accounts for regulated and unregulated energy should be adopted. Alongside a climate resilience target and an on-site site-area related generation target. The facility to automatically monitor and transmit actual energy use shall be provided. There should be a defined timetable for all these to be introduced during the next London Plan.

Implementation: The submitted project energy strategy will detail the design specifications and procurement measures adopted to deliver:

1. The kWh/m²/yr target.
2. Comfortable temperatures (whilst all HVAC systems are turned off for a period of 4 hours during peak winter and summer with today's climate.
3. Comfortable temperatures using 2050 climate data using installed and retrofitted measures that do not add energy consumption.
4. Automatic monitoring and transmission of actual energy use
5. The onsite generation target related to site area.

Justification: Adopting the kWh/m²/yr target keeps things simple and transparent, allowing for a comparison between the design and operational performance of a building. This allows pressure on designers' predictions to use realistic expectations of energy use, and on building operators to reconcile operating regime against intended. To be simple it is anticipated that all building types will be clustered under no more than half a dozen different kWh/m²/yr targets (due to the prediction errors being greater the difference between types). Building uses and not HVAC solutions shall define different targets – hence avoiding the current ideocracies brought about by an air conditioned office allowed as much as double that of a natural ventilated office.

The climate resilience targets ensure that buildings will be fit for purpose during their lifetime and are ready for the anticipated climate when London will be net zero carbon, addressing the overheating risk for the building's occupants and the problem of coolth poverty. It also anticipates the electrical grid peak demand management issues already being seen in warmer countries worldwide. This same policy objective provides a none proscriptive means to incentivise improved building fabric performance and less dependence on HVAC energy consuming measures.

The onsite generation target will assist with the diversification of the energy mix and the decarbonisation of the grid. This policy should be a kWh/m²/yr target related to the site area, not on the building energy use. Hence, large roof area shed buildings fully use their roof area potential to become major exporters, offsetting the limited roof area on high rise sites.

Outcome: These measures represent the first steps leading to net zero carbon buildings by 2050 that are comfortable to live / work in with reduced heating and cooling demands and high performing building fabric, with a diverse energy mix for London.

Stretch targets: All the targets shall have improvement timescales built into the London Plan period to provide transparency on future direction. This is to allow industry innovators to become pathfinders prior to wider implementation. The targets could be expanded to include the following measures implemented with the introduction of the five-year London carbon budget[1].

a. Requiring all buildings to be fossil fuel free or with a fossil fuel free plan by 2030. By: 1st Budget Period (2018-22)

b. Heat emission to atmosphere to be defined as a pollutant, hence promoting energy sharing loops to reduce heat rejection, encourage heat networks and reduce the heat island effect. By: 1st Budget Period (2018-22)

c. Demand response measures and peak shaving to reduce electrical power consumption during periods of maximum demand. By 2nd Budget Period (2023-27)

Recommendation 2 | A supportive district energy network

Proposal: District energy networks will be supported where there is a Local District Energy Strategic Plan in place. District energy should not be supported where there is no plan in place and alternative solutions demonstrate better than policy energy consumption.

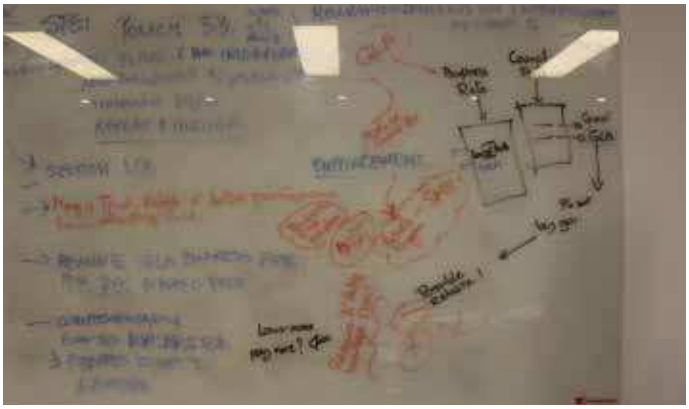
Implementation: To establish the Local District Energy Strategic Plan, a GLA District Energy Delivery Board should be established. The aim of the board would be to create strategy plans that address:

1. The commercial delivery of the plant including the platform for the transparent billing of customers
2. The interconnectivity around and across sites to grow the area network
3. Transparent appraisal and commercial plan
4. Going beyond the 'red line boundary' of new developments and link into existing buildings, complete with the associated transparent commercial plan
5. Have a fossil fuel free by 2030 plan

Where there is no plan in place alternative solutions for delivering low demand buildings that exceed the kWh/m² target and achieve compliance with the climate resilience and onsite generation targets should be given approval.

Justification: Current London Plan policy is prescriptive enforcing the application of CHP, tying buildings into relatively poor carbon performance and stifling the opportunity for innovation to deliver low carbon energy efficient buildings. Without a plan to decarbonise the district energy networks It is also potentially locking customers into increased energy bills. Furthermore, the current London Heat Map is disjointed and doesn't outline the full potential for unlocking existing buildings. The longer-term vision for heat networks is required. This is expected to encompass:

- Zero combustion and zero fossil fuels
- Heat emitted to atmosphere defined and penalized as a pollutant (creating UHI, adverse local micro-climates, increased cooling energy needs, etc.). Hence all AC rejects its heat via heat pump into the heat network
- Heat network migrating to a low temperature heat sharing network and a source for all thermal energy needs via building connection heat pumps
- All building heat / cooling demands to be smoothed using on-



site thermal-storage / thermal-mass / etc. across 24-hours to better balance heat / cooling demands on the network

- System / HVAC electrical demands to be 24hr site smoothed using time-of-day tariffs to reduce heat-pump peak loads on the electrical grid
- Incentivise new-build to achieve site 'Heat-Autonomy' i.e.: using building heat sources (e.g. people and processes) to avoid any heat import or export

Outcome: There would be a zero-emissions transition plan in place. Customers would not be faced with increasing energy bills as the future carbon intensity of gas is considered. There would be a transparent comparison between the differences in the prices customers are paying for the supply of heat. The strategic plans would also help to maximise the full potential of the network. LPAs would understand the heat loads around new developments, allowing for connections into the wider community, ensuring that benefits are not just realised for new developments.

Recommendation 3 | A carbon offsetting fund that transparently saves carbon

Proposal: A carbon offsetting fund that is based on offsetting regulated and unregulated emissions to achieve net zero energy. Including unregulated energy puts an incentive on reducing oversized and inappropriate occupier HVAC. The carbon offsetting fund is based upon design data at the planning stage, with yearly reports issued by LPAs to confirm how the money has been spent and the resulting carbon emissions that have been offset from the investments. LPAs will have 5 years to spend the funds or the money is passed onto the GLA or returned to the developer. A performance metric will also be added to the carbon offsetting fund so that the offset price changes depending upon how much energy has been reduced on site.

Implementation: This will be implemented through the same S106 obligations as the current carbon offsetting fund.

Justification: The standard GLA carbon offsetting fund is based on regulated energy only, which needs to be amended if London is to achieve a net zero carbon target by 2050. LPAs are currently facing barriers to spend the money, with lawsuits in place for developers trying to recoup the funds. NABERS experience indicated that unregulated energy can be included given time for the industry to understand implications and evolve accordingly with the right incentives in place.

Outcomes: The carbon offsetting fund will offset both regulated and unregulated energy as standard moving London towards being net zero carbon by 2050. As LPAs will be required to publish annual Carbon Offsetting reports and spend the money within 5 years, the benefits from the carbon offsetting fund will be transparent and tangible, improving confidence in energy policy.

Stretch target: The carbon offsetting price could be doubled every time a new London Carbon Budget is introduced to increase the focus on the delivery of onsite measures to reduce energy demand.

Recommendation 4 | Work Towards Occupancy Based Policy

Proposal: S106 obligations to include an obligation for the developer and building owner to facilitate the collation and transmission of energy data for the first 5 years of occupancy.

Implementation: This will be implemented through the S106 Agreement.

Justification: There is a lack of data on the performance of existing buildings, with a gap between the expected design performance and the actual operational performance of a building.

Outcome: By collating this data, design methodologies can start to incorporate the data and improve the accuracy of modelling to reflect real time performance. It can also highlight potential barriers as to why the expected building performance and the actual operational performance differ. The naming and shaming of the worst performers may encourage building users to take energy conservation more seriously.

Stretch target: Implement an occupational performance rating scheme that rates the environmental performance of existing buildings. This could be stretched further to mandate that existing buildings must achieve a rating. To deliver such a scheme the Australian NABERS scheme could be adopted with the DEC rating of a building being used to confirm the building's performance.

Alternatively, BREEAM In Use could be mandated for all relevant building types.

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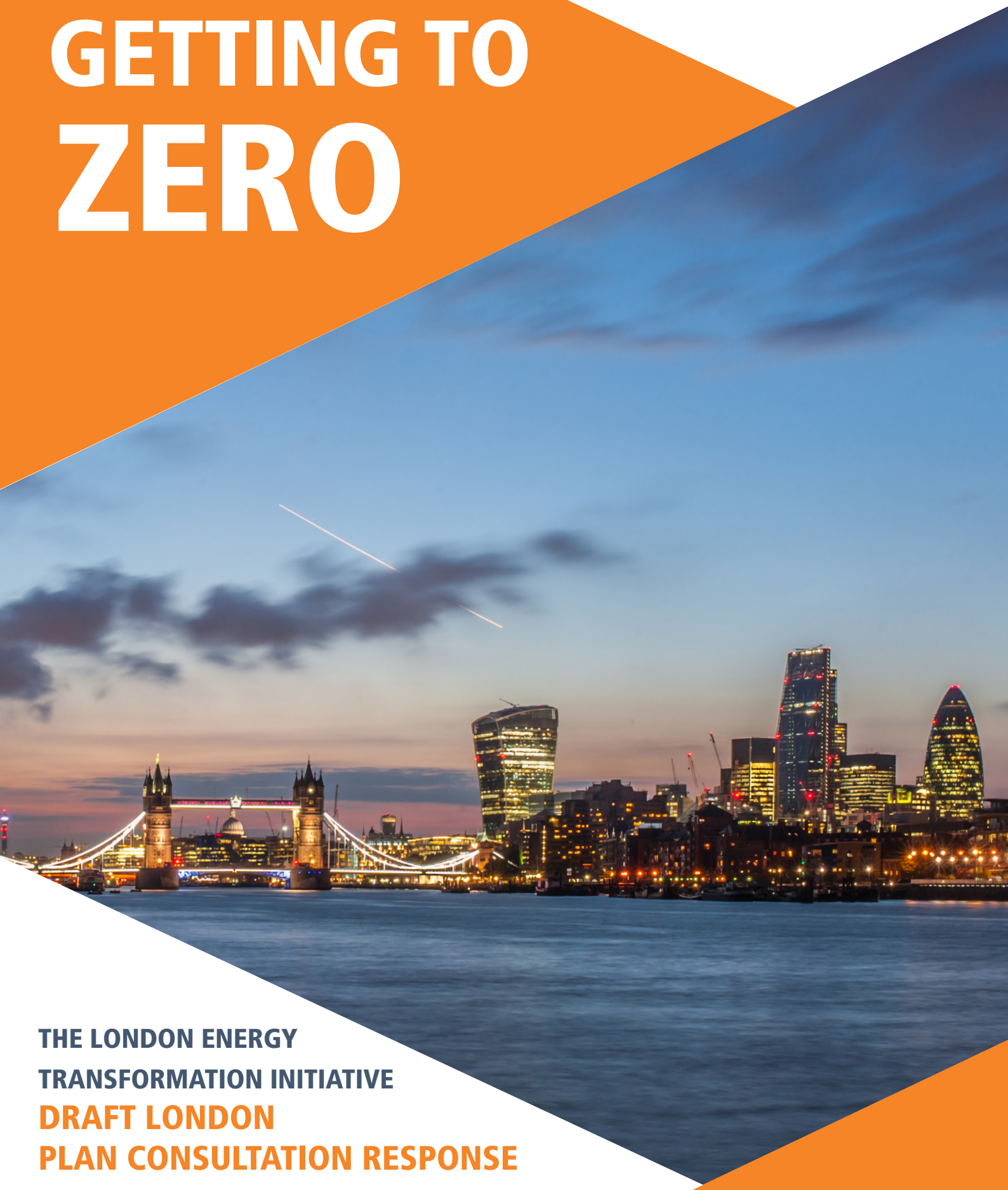
GETTING TO ZERO



THE LONDON ENERGY TRANSFORMATION INITIATIVE

DRAFT LONDON PLAN CONSULTATION RESPONSE

FEB 2018

Acknowledgements

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Clara initiated the process of collaboratively developing energy policy recommendations, which led to the development of the London Energy Transformation Initiative. She was recognised as the UKGBC Rising Star of 2017, partly in recognition of her work on energy policy and low energy building design, and is a Mayor's Design Advocate for Good Growth.

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elementa
Member of Integral Group

Elementa Consulting created the London Energy Transformation Initiative in 2017 in response to the frustrations they experienced as building services engineers applying current energy policy. Avoidable climate change and air quality impacts were being encouraged by a policy framework that was no longer delivering on its objectives. LETI was founded from Elementa's belief that the pathway to a Zero Carbon London can only be defined through robust dialogue and open collaboration - between policy makers and the broadest possible cross-section of built environment professionals.

Executive summary

LETI supports the London Plan's objective of achieving a fully Zero Carbon London by 2050, meaning that all buildings will have to operate at zero emissions by 2050. With our broad support base across the industry we believe this target is not only possible, practical and achievable, but it will also further support London's prosperity and skills growth. Drawing on our collective experience gathered from both the UK and abroad, LETI's research shows that meeting this objective will require an ambitious trajectory of milestones and ratcheting targets that must be included in the London Plan.

LETI believes a key milestone is ensuring all new buildings operate with zero emissions by 2030. This reflects parallel thinking in Europe[1], the USA[2,3] and the World Green Building Council[4] and is due to the fact that:

1. Currently each new building represents an increase in London's total carbon emissions, a figure which needs to be greatly reduced.
2. Achieving operational zero emissions for new builds will require a shift in how we design, construct and operate buildings. This change will not happen overnight, these principles will need to be applied to new builds as soon as possible and then rolled out to existing buildings.
3. We must ensure that buildings we construct in the next few decades do not add to the large number of buildings that will have to undergo major retrofit to achieve operational zero emissions by 2050.

The London Plan must set out details of the wider context of delivering operational zero carbon new buildings by 2030. Achieving this target will mean departing from the current national policy framework, in order to shift the industry away from 'design for compliance' by implementing performance outcome based policies.

Policy is seen as the primary driver of a step change to zero carbon, arguably the most far reaching sustainable issue affecting London's future. Unless the GLA, advised by industry experts, can enact and support ambitious policy change there is little hope in meeting zero carbon targets. In light of long term serious implications from climate change, "viability" must be seen with a long term lens to secure London's future as a vibrant global city.

Why LETI believe that current policies will not deliver zero carbon buildings:

1. New buildings are not performing as calculated, on their claimed carbon reductions by a significant margin.
2. The 'Zero Carbon' definition that the GLA currently uses, based on a % reduction on Part L, falls well short of operational zero carbon buildings.
3. Low energy solutions are being positively hindered by Building Regulations Part L calculation methodology. For example, outdated carbon intensities are driving unintended lock-in to fossil fuel and combustion air pollution.
4. Grid-decarbonisation is being delivered by energy providers. This will benefit the construction industry but should not be seen as its own achievement.
5. The construction industry needs to make its own contribution to national carbon reductions by reducing energy used on-site and minimising peak demand.

Click here for the GLA definition of zero carbon

LETI believes that the following policy changes are required to deliver operational Net Zero Carbon for new buildings by 2030:

1. 'Operational Zero Carbon' by 2030 for all new buildings - this moves beyond the current definition of a 'design prediction' using a 'percentage CO_2 reduction', to deliver actual operational and measured zero carbon buildings.
2. An absolute kWh metric - to allow the full range of stakeholders involved in the design, operation and delivery of our buildings to understand and therefore fully contribute to reducing energy consumption.
3. Adding a 'Be Seen' stage to the energy hierarchy - we fully support the inclusion of energy monitoring, this is seen as fundamental to achieving operational zero emissions and thus should be elevated into policy SI 2 A.
4. Energy strategies to demonstrate future-proofing to 'Operational Zero Carbon' on-site by 2030 - we support clause 9.2.10 i of the draft London Plan, but believe leaving it until 2050 will only encourage further lock-in to fossil fuel and urban combustion pollution.
5. Addressing whole life embodied carbon to be explicitly included in Policy SI 2 - to drive innovation addressing what will become the largest building carbon emissions challenge once operation carbon is reduced.
6. A zero emissions by 2030 transition plan to be provided for all district heat/energy networks, alongside disclosing energy usage and efficiency data to ensure that networks are part of the solution to delivering operational zero emissions.
7. The heating hierarchy to be renamed and rearranged to emphasise the changing priorities of a trajectory to a zero carbon London.
8. The importance of minimising energy demand peaks to be strengthened.
9. 'Mayor's Energy Advocates' to be available for boroughs to assist in ensuring sustainable design is embedded, as a parallel to the Mayor's Design Advocates.

1. https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings, 2. http://architecture2030.org/, 3. British Columbia Step Code http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/reports/step_code_sciwg_report_final.pdf, 4. http://www.worldgbc.org/advancing-net-zero

Contents

The views and recommendations outlined in this report reflect the discussions from the London plan workshop and further discussions with the LETI taskforce and do not necessarily reflect the views of all of the individual organisations listed as supporters on the back cover.

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5 Workshop Focus Areas

1. **Path to Zero Carbon**
2. **Energy Monitoring**
3. **Heating Hierarchy**
4. **Demand Management**
5. **Embodied and Whole Life Carbon**

Introduction

The London Energy Transformation Initiative (LETI) is a network of over 300 built environment professionals that are working together to put London on the path to a zero carbon future. The voluntary group is made up of developers, engineers, housing associations, architects, planners, academics, sustainability professionals, manufacturers, membership bodies, contractors and facilities managers, with support and input provided by the GLA and London boroughs. LETI was established to work collaboratively to put together evidence-based recommendations for two pieces of policy – the new London Environment Strategy and the rewrite of the London Plan.

Click here to access previous LETI reports

This report summarises the outcomes and recommendations of LETI's consultation response on the draft London Plan. The GLA invited LETI to host a consultation workshop for the London Plan focusing on zero carbon, energy monitoring, the heating hierarchy, demand management and embodied carbon.

A workshop was held in January 2018 at City Hall with more than 60 industry contributors to review the draft policy in Chapter 9,'Sustainable Infrastructure', focusing on SI 2, 'Minimising greenhouse gas emissions' and SI 3, 'Energy infrastructure'. Attendees included developers, engineers, architects, planners, sustainability professionals and facilities managers. The purpose of the workshop was to analyse and test these policies in detail to determine whether they need to go further to meet the overarching sustainability aims of the GLA. The outcomes of the workshop have been summarised in this report, providing feedback on the wording of the polices, suggestions for Supplementary Planning Guidance (SPG) content and advice for the GLA to help support the policy implementation at borough level. LETI is in support of the new Draft London Plan objectives and seeks to assist in developing policy wording to ensure it achieves them. Most of LETI's concerns are readily acknowledged by policymakers, as well as the wider industry, which include the unintended consequences of industry practices, previous policy and regulation constraints. Lack of transparency in process, responsibility and final delivery also hinder progress further.

LETI's vision is for a planning process and set of policies that focuses all stakeholders on verified operational building outputs, aligned with genuine zero carbon targets and the longer-term infrastructure limits. Evidence from industry bodies suggests that a more transparent process would also help deliver less complex and less costly buildings. The focus areas of this report have evolved from previous LETI work and further discussion with the GLA.

LETI 2018 - get involved

As well as advising policy makers on policy changes, we must also implement the LETI principles within our everyday work and advocate that others do the same. LETI is therefore running three workstreams in 2018 that look to move us closer to a zero emissions London.

Advancing Net Zero

Developing a Zero carbon framework with the UKGBC

As part of the global Advancing Net Zero campaign, this project will develop a framework for net zero carbon buildings for the UK market which builds on existing initiatives and standards.

Leading By Example

Developing a LETI appendix for energy statements

How can the industry go further than the standard energy statement. This could involve providing additional information (e.g. kWh/m^2), or proposing an alternative approach to compliance e.g. adopting "Design for Performance".

LETI Legacy

Implementing the LETI principles

How we can practically implement the positive outcomes of LETI over the long-term and to keep the programme active beyond the London Plan consultation. For example it may be that we form an advisory panel that could assist local authorities.

Register to get involved with the LETI 2018 workstream at www.leti.london

Path to Zero Carbon

Click here to access previous working group report on energy strategy targets. See pages 12-13

LETI believes that current policy relating to carbon emissions in buildings in London will not deliver Net Zero Carbon for new buildings by 2030. We therefore recommend the following changes are made to strengthen and reinforce the policy.

Draft policy wording

Policy SI 2 - Minimising green house gas emissions

"A. Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy: ...

C. ~~In meeting the zero-carbon target~~ a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should ~~aim to~~ achieve 10 per cent, and non-residential development should ~~aim to~~ achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:

1) through a cash in lieu...

2) off-site..."

Supporting text - 9.2.10

As a minimum, energy strategies should contain the following information:

"i. Proposals explaining how the site has been future-proofed to achieve zero-carbon on-site emissions ~~by 2050~~."

In LETI's view, all new buildings should be zero carbon emissions in operation by 2030. This differs from the GLA definition of net zero carbon.

Remove "in meeting the zero carbon target". This over-represents the impact a 35% reduction beyond Building Regulations would have on achieving operational zero carbon.

Remove "aim to" and introduce "a minimum of" to provide a clear level of performance.

Alter wording to include a 2030 zero carbon requirement.

Our suggested wording

Policy SI 2 - Minimising green house gas emissions

A. Major development should have zero carbon emissions in operation by 2030. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy

C. [text removed] A minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should [text removed] achieve a minimum of 10 per cent, and non-residential development should [text removed] achieve a minimum of 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:

1) through a cash in lieu...

2) off-site... "

Supporting text - 9.2.10

i. Proposals explaining how the site has been future-proofed to achieve zero-carbon on-site emissions in operation by 2030.

Suggested SPG content

- In LETI's view, all new buildings should have zero carbon emissions in operation by 2030. The full meaning of zero carbon and a long term action plan will need to be formed to ensure this goal is achieved. This differs from the GLA net zero carbon definition. The SPG should contain clarity on a long term plan to achieve zero carbon emissions in operation.
- Provide a link to the most up-to-date carbon factors for consultants to use in energy reports alongside the dated Building Regulation Part L values.
- Request the use of an alternative kWh/m^2 metric for comparison of energy demand between developments. Seek to adopt a kWh/m^2 metric in future policy.
- Request the calculation of unregulated energy/CO_2. Building Regulation Part L and planning carbon targets currently ignore unregulated carbon.
- Request that applications consider: plant space; demand response readiness; energy storage; natural ventilation readiness; glazing tech/fabric upgrade readiness; design for low temperature systems including larger radiators, underfloor heating and use of heat pumps, etc.
- Quantitative demonstration of future proofing should be encouraged.

Actions for GLA to support policy implementation

- Develop a more accurate and ambitious approach to energy and carbon calculations in London. LETI believe that London should first and foremost make the right choices to deliver its own carbon targets rather than being concerned with consistency with a national context (Building Regulations Part L methodology), which is not delivering a true picture of carbon emissions reductions. Refer to page 3 of this report to see why LETI believe that current policy will not deliver zero carbon buildings.
- Energy Advocates could be used to help write SPG's and assist local authorities with technical skills required to appraise applications. (similar to the Mayors Design Advocates program),
- Provide more clarity on what happens to cash-in-lieu offset payments.

Energy Monitoring

LETI believe that only when buildings are monitored and measured can we understand if they are performing as intended or calculated. Therefore, we propose that the introduction of energy monitoring is strengthened in policy and added as a bold new fourth step in the energy hierarchy.

Draft policy wording

Policy SI 2 - Minimising green house gas emissions

A. Major development... in accordance with the following energy hierarchy:

1) Be lean...

2) Be clean...

3) Be green...

B. Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and ~~will be expected~~ to monitor and report on energy performance

Supporting text - 9.2.9

"The move towards zero-carbon development requires comprehensive monitoring of energy demand and carbon emissions to ensure that planning commitments are being delivered. Major developments are required to monitor and report on energy performance~~, such as by displaying a Display Energy Certificate (DEC) and reporting~~ to the Mayor for at least five years via an online portal to enable the GLA to identify good practice and report on the operational performance of new development in London."

Supporting text - 9.2.10

As a minimum, energy strategies should contain the following information:

"h. ~~Proposals~~ for how energy ~~demand~~ and carbon emissions post-construction will be monitored annually (for at least five years)."

Remove "will be expected to", to prevent ambiguity.

move monitoring into the energy hierarchy and re-phrase to include the word "verify".

Swap the word "demand" for "consumption".

Move clarification on monitoring and reporting techniques to the SPG as these may change over time thus shouldn't be in policy

Remove "proposals for" and ask design teams to "demonstrate".

Swap the word "demand" for "consumption".

Add the words "monthly and reported" for clarification.

Our suggested wording

Policy SI 2 - Minimising green house gas emissions

A. Major development... in accordance with the following energy hierarchy:

1) Be lean...

2) Be clean...

3) Be green...

4) Be seen: monitor, verify and report on energy performance in use.

B. Major development should include a detailed energy strategy to demonstrate: how the zero-carbon target will be met within the framework of the energy hierarchy; and [text removed] to monitor and report on energy performance

Supporting text - 9.2.9

The move towards zero-carbon development requires comprehensive monitoring of energy consumption and carbon emissions to ensure that planning commitments are being delivered. Major developments are required to monitor and report on energy performance [text removed] to the Mayor for at least five years via an online portal to enable the GLA to identify good practice and report on the operational performance of new development in London.

Supporting text - 9.2.10

h. Demonstrate how energy consumption and carbon emissions post-construction will be monitored monthly and reported annually (for at least five years).

Suggested SPG content

- A clear list of required figures for applicants to monitor, collect and submit. This should include frequency of data collection and submission.
- Proposals for energy monitoring of major new developments during the first five years of operation should measure the following, in order of priority:
  1. **Base building energy use**: regulated energy uses defined by Building Regulations. This correlates with the responsibilities of the developer, their designers, contractors and building managers.
  2. **Whole building energy use:** regulated and unregulated energy uses to capture the total carbon footprint relating to London's objective to become a zero carbon city.
  3. **Energy used directly by each occupier in a multi-let non-domestic building:** this is the difference between the whole building energy use and base building energy use; measuring it gives agency to non-domestic tenants to manage their contribution to the total carbon footprint. For domestic buildings this is dealt with as part of the base and whole building energy use.
- Examples of data collection methods for non-domestic buildings such as display energy certificates (DEC) and landlord energy ratings (LER). Note that DECs mask the activities of individual tenants in multi occupier buildings, so should be complemented by base building ratings and individual outputs from each tenant.
- Request data on efficiency and energy usage to be disclosed from heat networks specifically.
- Request the reporting of energy and carbon per person and per m^2.
- Refer to current Islington Council policy for examples of monitoring in practice.

Heating Hierarchy

Click here to access previous working group report on district heat networks. See pages 14-17

LETI supports the need for a unified policy on energy infrastructure, for which heating and cooling networks are of particular importance. To reflect the complexity of implementing energy infrastructure, we have combined the detailed discussions of the established LETI decarbonising heat working group with the outcomes of the January 2018 London Plan workshop.

Draft Policy wording

Policy SI 3 - Energy infrastructure

"D. Major development proposals within Heat Network Priority Areas should have a communal heating system.

1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a. *connect to local existing or planned heat networks*

b. *use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)*

c. *generate clean heat and/or power from zero-emission sources*

d. *use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)*

e. *use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)*

f. *use ultra-low NOx gas boilers."*

Swap clauses a. and b. and re-phrase to include energy sharing and efficiency measures.

Merge clauses c. and d.

Merge clauses e. and f. and re-phrase.

Our suggested wording

Policy SI 3 - Energy infrastructure

D. Major development proposals within Heat Network Priority Areas should have a communal heating system.

1) the heat source for the communal heating system should be selected in accordance with the following low carbon heating hierarchy:

a. connect to an energy sharing network through the capturing and using of waste heat and/or use of available local secondary heat sources.

b. connect to a local existing or planned heat network where it is demonstrated to be running efficiently, the cost of heat to occupants is comparable to national average heating fuel costs, and there is a zero emissions transition plan in place to ensure that the development achieves zero carbon emissions in operation (if it is not already fossil fuel free).

c. generate clean heat and/or power from zero-emission sources (examples include: solar technologies, heat pumps and energy storage powered by renewables).

d. use low emission combined heat and power (CHP) (where suitable for size and demand of development) or ultra-low NOx gas boilers (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler). If the development uses fossil fuels then a zero emissions transition plan must be in place to ensure that the development achieves zero carbon emissions in operation by 2030.

Suggested SPG content

- Promote efficient low or zero carbon solutions for each development size and type. This will change over the lifetime the technology is installed for. The inclusion of heat networks should not override all other decision making processes.
- Provide guidance on appropriateness of heat networks to new development that is outside heat network priority areas or has low heat demand. Guidance could suggest applicants skip to part c. of the heating hierarchy where applicable.
- Ask applicants to be clear on assumed local air quality impacts/ limits and estimate likely annual energy costs to see if they represent a risk in terms of fuel poverty.
- Request the disclosure of heat network carbon factors used for calculations and during the lifetime of the operation of the plant. This is essential to understand the assumptions made by applicants and whether they are realistic.
- Provide links to guidance on low temperature heat networks and energy sharing within and between developments.
- Where heat pumps are proposed by applicants, encourage a shift away from high global warming potential (GWP) refrigerant use.
- Where LETI's suggested policy wording (above) is adopted, include a definition of an 'energy sharing network' and the requirements of a 'zero emissions transition plan'.

Actions for GLA to support policy implementation

- Update the London Heat Maps to include current plant and in-use efficiency data on heat networks.
- Create strategic plans with local authorities for heat network opportunity areas. This should not be left to developers to determine, there is a strategic role here.
- Lobby government to class heat network infrastructure as a nationally recognised utility.
- Provide support for local authorities to follow-up on zero emissions transition plans and ensure implementation.

Demand Management

LETI feel the prescriptive measures outlined in the draft policy wording do not in themselves constitute a demand response or management measure. While smart meters, smart grids and micro grids could lead to a reduction in peak demand, this is not necessarily always the case.

As an overarching point, we believe that the words 'demand response' in policy should be replaced with 'demand management'. This is because we feel that demand should be proactively managed rather than responded to.

Demand management is a fast moving industry, so we have suggested that technological responses which could quickly become redundant are not listed in policy, but reserved for the SPG.

Draft policy wording

Supporting text - 9.2.10

As a minimum, energy strategies should contain the following information:

"g. Proposals for demand-side response, specifically through installation of smart meters, minimising peak energy demand and promoting short-term energy storage, as well as consideration of smart grids and local micro grids where feasible."

Reword text to encourage variety and innovation in applications and remove proscriptive technologies

LETI strongly feel the word 'response' should be replaced with the word 'management'

Our suggested wording

Supporting text - 9.2.10

g. To anticipate infrastructure capacity challenges for a growing London, submit proposals for energy demand management and reductions in peak energy demand.

Suggested SPG content

- Suggested building components and measures for addressing demand management could be listed alongside both potential and adopted measures. These should consider the effect on the national energy network, local energy network and end user.
- Apply caution where developers/installers offer smart meters, smart grids and micro grids without putting in place energy management facilities for when the building is completed and in-use.
- Applicants could be asked to compare demand response measures to a base case building and should be measurable rather than a vague statement, for example:
    - Evidence should be provided that peak energy demand does not occur during certain defined summer and/or winter months when infrastructure capacity is particularly constrained (now or in the future). This could be progressed to a percentage reduction target and eventually time of day reductions once further data is available.
    - List annual peak demand and peak demand for each month both in absolute and per square metre metric for regulated and un-regulated energy, including shared building services, plant and car charging to allow data to be gathered and inform further refinement of this policy.
- A demand response hierarchy could be developed to guide applicants.
- Request applicants to discuss capacity and effects of development to the local electrical substation.
- For unregulated loads, provide specific requirements to demonstrate they have been reduced. Consider measures that influence consumer behaviour and better targeting of demand management.
- Long term effects of demand management measures should be considered, such as the effect of domestic half-hourly billing and an increase in renewables (e.g. wind) during winter months.
- Consider measures for future proofing buildings, in particular, how vulnerable residents will be protected from market changes, such as the introduction of high cost kWh tariffs during periods of peak grid demand.

Actions for GLA to support policy implementation

- A clear methodology must be outlined – this will make it easier to enforce while also providing simple recommendations.
- References to standards and accepted calculation methodologies should be made where available.
- Guidance should be made as to how technological changes will be dealt with.
- Simple compliance options could be developed and made available.
- Refer to examples such as Californian Building Code, which reduces allowable grid demand during peak grid demand months.
- Assist local authorities in collecting data at a borough level and collate to outline typical profiles and examples of best practice.

Embodied and Whole Life Carbon

Requiring embodied carbon calculations within the London Plan would enable the collection of data so that benchmarking can be undertaken in the future. This would assist in creating a shift in the industry so that developers, consultants and clients become used to undertaking these assessments on projects.

Ultimately the aim is to start the behavioural change around embodied carbon within the construction industry and firm support from the London Plan will support this. Our recommendation is to consider Whole Life Cycle Carbon in parallel to Operational Carbon within policy SI 2 as both are complex issues on their own and key to achieving Net Zero carbon buildings.

Draft policy wording

Supporting text - 9.2.10

As a minimum, energy strategies should contain the following information:

"k. Proposals to minimise the embodied carbon in construction"

Strengthen wording to take into account the whole life cycle of materials as well as the the embodied carbon.

Consider bringing life cycle carbon into policy though the addition of a clause in policy SI 2.

Our suggested wording

Supporting text - 9.2.10

k. Proposals to demonstrate actions taken to minimise whole life cycle carbon

Policy SI 2 - Minimising green house gas emissions

E. Referable schemes should quantify whole life carbon through a nationally recognized Carbon Life Cycle Assessment (Carbon-LCA) & demonstrate actions taken to reduce lifecycle carbon informed by this analysis.

Suggested SPG content

- Carbon lifecycle assessments can identify significant scope to reduce carbon impacts, through design, reuse, recycling, sourcing, disposal and substitution of materials with lower carbon or more durable alternatives. These factors should be considered in demonstrating actions taken to minimise whole life carbon.
- BS EN:15978 provides an appropriate methodology to quantify the whole life carbon in a development (including embodied carbon). In November 2017 RICS published a guide "Whole life carbon assessment for the built environment, first edition" which sets out consistent principles and practical guidance on the application of EN 15978.
- The SPG must set out scope boundaries and a reporting framework so that it is clear what elements of life cycle carbon have been included. This should include:
  - Which building elements to be included (1.1 substucture, 2.1 frame etc as per BCIS definition)
  - The reference service life- eg 60 years
  - Lifecycle boundary information- ie product stage, transport, operational energy and disassembly
  - If disassembly of existing buildings that are to be demolished as part of the development are to be included
  - If biogenic carbon storage (CO_2 content locked in wood) is included
  - The format of the calculation and how this is itemised
  - Embodied carbon data should be taken from Environmental Product Declarations (EPDs) to EN 15804 or ISO 14025 where available, or other reputable databases where EPDs are not available
- Explain the relevant definitions:
  - Embodied carbon – the carbon emissions from sourcing raw materials, processing and fabrication, transportation and assembly on-site.
  - Whole life carbon – the carbon emissions from embodied carbon and carbon emissions associated with operation, repair, replacement and disassembly.
  - Operational Carbon – the carbon emissions from the systems used in the operation of the development ie, HVAC domestic hot water and lighting.

Actions for GLA to support policy implementation

- It is noted that local authorities can only enforce elements of the plan which are policy. Therefore, it is recommended that embodied carbon/ whole life carbon is included within policy SI 2.
- Given that the aim at this stage is to collect data to enable benchmarks in future, it is recommended that the GLA provides a central repository for this information to collect the embodied carbon calculations from all boroughs. This will also reduce the burden on local authorities.
- A simple online tool or spreadsheet could be provided by the GLA for applicants to complete. This would speed up data collection and ease comparison.
- LETI members have working examples of embodied carbon and whole life cycle carbon emissions calculation and are available to provide further advice for the SPG.

Referable schemes

"An application is referable to the Mayor if it meets the criteria set out in the Mayor of London Order (2008). The criteria includes:

- *development of 150 residential units or more*
- *development over 30 metres in height (outside the City of London)*
- *development on Green Belt or Metropolitan Open Land".*

Click here to access the Mayor's full definition of referable schemes

Appendix

This appendix documents the outputs generated by each of the five working group tables at the January 2018 LETI London Plan workshop at City Hall.

Workshop Notes

This section contains the notes of the discussions of each workshop table group:

1. Path to Zero Carbon
2. Energy Monitoring
3. Heating Hierarchy
4. Demand Management
5. Embodied and Whole Life Carbon

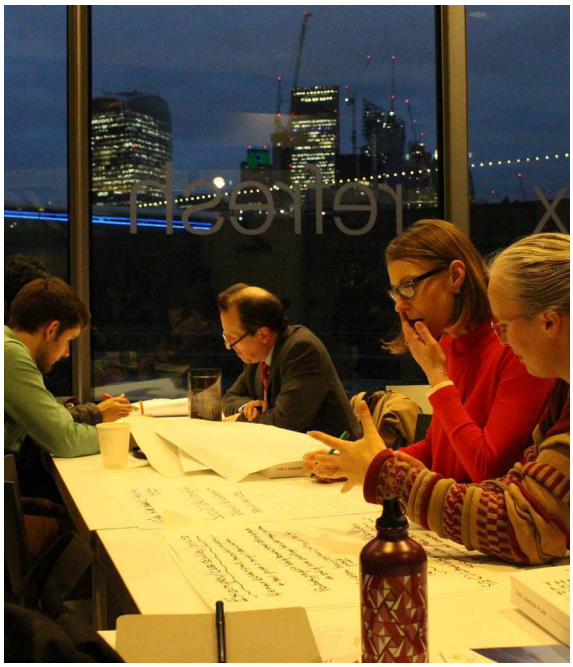
During the workshop each table worked though a series of discussion points and questions relating to their topic and applicable London Plan draft

poilcy. The questions were designed to draw out the effectiveness of the draft policy, whether any amendments to wording changes should be suggested and what guidance should be provided in supplementary planning guidance (SPG's)

Each table included a facilitator to ensure the talking points of the table were addressed and a note keeper to record the key points that would inform this report.

After the workshop an initial draft of the findings was written up by the notekeeper and facilitator. The participants of each table were then given the opportunity to comment on the draft notes to ensure that the whole discussion was captured.

The notes shown in this appendix do not necessarily represent the views of LETI but are a record of the conversations of the LETI consultation workshop.



1 – Path to Zero Carbon

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Jennifer Juritz - David Morley Architects

Juergen Koch – 4 Green Architecture

Samantha Crichton - Ecuity Consulting

Stephen Gallacher - WSP

Susie Diamond - Inkling

Thomas Lefevre - Etude

Tom Dollard - Pollard Thomas Edwards

Tom Randall - Verco

Wayne Head - Curl la Tourelle Head Architects

Specific recommendations

1. Update CO_2 factors to current values.
2. In SI 2 C, remove "aim to" to provide a clear level of performance, rather than inciting "excuses". New wording would be "residential development should achieve 10%, and non-residential development should achieve 15% through energy efficiency measures".
3. In SI 2 B ,remove "be expected to" with regard to monitoring and report. Again, clear direction and removing the ambiguity of the sentence. Also replace "monitor" with "verify" which will encourage designers to model their buildings in such a way that operation energy can be measured and compared/ benchmarked.
4. In SI 2 C, remove "in meeting the zero carbon target" at the start. This over-represents the impact that a 35% reduction beyond Building Regulations would have on achieving zero carbon. Subsequent reference to residential and non-residential developments in the paragraph may need reference to being "major developments" as noted in SI 2 A.
5. SPG inclusions for future proofing (9.2.10-i):

- Submissions should consider:
  - Plant space
  - Demand response readiness
  - Energy storage
  - Natural ventilation readiness
  - Glazing tech/fabric upgrade readiness
  - Design for low temperature systems, including larger radiators or underfloor, use of heat pumps, etc.

- Submissions could be based on a tick list (maybe with hierarchy), with justification of why elements have not been implemented.
- Training for planning officers to understand the above and consider decisions beyond 'the offset'.
- Quantitative demonstration of future proofing should be encouraged. For example, future PV allowance and carbon benefit. Or a comparison to a fixed kWh/m^2 benchmark for the given building typology.

Broader recommendations

- Adopt a kWh/m^2 metric.
- Include consideration of unregulated energy/CO_2. The definition of zero carbon in the London Plan glossary purports to include all "activities" that release CO_2 and green house gases to the atmosphere. But our metrics and targets ignore unregulated carbon.
- Benefits of an approach similar to NABERS:
  - More detailed and accurate modelling, including unregulated energy and controls, which focuses design efforts on realisable carbon reduction measures.
  - Mandatory disclosure allows market forces to drive innovation and building performance.
  - Consideration of operational energy in-use and its measurement. And commitment agreement to achieve performance.
- Step change required.
- There was agreement that zero carbon targets are unlikely to be met with business as usual London Plan with a few small tweaks and additions.

What does zero carbon mean and what should the long-term timelines be to achieve zero carbon? Is it clear what is meant with 'zero carbon target' in policy SI 2 B and zero-carbon on-site emissions' from 9.2.19 i.?

- Defining zero carbon is crucial. There is ambiguity within the London Plan as to the consideration of operational carbon and embodied carbon.
- A percentage reduction is not clear – kwh/m^2 would be a better metric.
- The carbon offset is misrepresented with a small portion in the supporting graphic, when in reality it means 'passing the buck' and accounts for a much large proportion of the carbon calculation. Needs to be clearer.
- Case studies would be helpful.

What needs to be implemented to achieve zero carbon can these be implemented through the current wording of the London Plan?

- Key word missing is 'operational'.
- Everything is connected to Part L calculations, which are not a reasonable representation of building performance in operation. This means policy ties designers' hands to deliver buildings that do not necessarily result in zero carbon operation.
- More detailed models would be helpful (NABERS, TM54) to reflect operational energy more accurately – also allowing developers to explore other options for energy/carbon savings.
- There needs to be more detailed modelling but it will need to be robust enough not to go too far at design stage. Approach needs to be simplified.
- BREEAM is going the operational modelling route which will help for non-domestic developments.
- Carbon factors need to be fixed/updated over time, starting with an immediate update to current carbon factors. GLA in agreement with this so far.
- Post-occupancy is required to close the performance gap.
- London Plan is too BAU (business as usual) and a bigger step change would be required (eg. operational modelling).
- Overheating TM59/52 requirement is great – something similar could be done for operational energy.
- Could we target specifically saving for fabric and not services? Current design tools might have unintended impacts for things like overheating/ventilation when pushing fabric too far.

Provide changes to wording of Policy SI2 B and of 9.2.10 i and other instances that discuss zero carbon targets

- "…expected" > "will be required to monitor"; "monitor" > "verify".
- Section C. could remove "in meeting zero carbon".
- Clarify difference between monitoring energy and monitoring carbon.
- Section C. "should aim" > "should achieve a minimum of".

Provide recommendations on the content of an SPG that provides guidance on how to write this future ready on-site zero emission statement in an energy strategy

- Modelling needs to be an iterative process to refine predictions at design stage through to operation.
- Clear guidance on designing buildings to be demand response ready/mixed mode ready.
- Guidance on considering what will happen in the future and reconsider what's being done now.
- Most key plant will last only 20 years. Plant space is key – flexibility needs to exist.
- Need to design for recycling building components as this allows for upgrade/change. How does the role of BIM influence this?
- What carbon factor do we use for a 2050 prediction if quantitative?
- Consideration of using new/better glazing with BIPV in the future?
- Consider Bill Gething's 'Design for Future Climate'.
- Guidance that calls only for a narrative response may lead to 'standard' narratives that do not effect change. Quantitative calculations can help designers think about their designs more thoroughly.
- BREEAM Wst06 could help.
- Future-ready narrative/calculations could be hierarchical as for cooling, or potentially be a list with tick box options.
- 'Boiler plus' for lowering flow temp in the future. e.g. larger radiators, space for heat pumps.
- Future proofing should consider future climates.
- kWh/m^2 target should be part of future proofing calculation.

What should a Planning Officer look for in a submitted energy strategy to demonstrate ZC will be met (recognising that a borough planning officer may well not be an energy specialist)?

- A quantitative response, rather than just a standard narrative. However, care must be taken, as a quantitative approach probably does not preclude loopholes as assumptions can be tweaked (eg. CO_2 factors).
- Need monitoring and KPIs for next 30 years – road map.
- Mandatory DECs.
- Commitment agreement as per NABERS could help.
- Reduce focus on the offset payments. Education and resources for LPAs is required.
- Denmark is example of focusing on grid and district energy and not so much on energy efficiency.

2 – Energy Monitoring

Participants

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Discussion - why is it important to have energy use monitoring and reporting?

- The monitoring and reporting of building energy data will have several major benefits, but essentially it will put in place accountability and hopefully drive improved design, installation and operational performance. League tables will both create competition while also 'naming and shaming' poor performers throughout the supply chain. While developers may see this as an increase in risk, this would in turn provide better confidence to purchasers of new homes and buildings that the property would be more likely to perform as advertised. In time, certain developers may also use this as a differentiator within the market and want to report back good performance within their portfolio to stakeholders. This may in turn encourage users to continue using the platform beyond the minimum reporting period.
- This system would also allow tenants to hold landlords to account for poorly or under-performing systems; forcing them to make improvements and potentially resulting in reduced utility costs for tenants while allowing future tenants to better predict utility costs. It is likely that further information will need to be made available to the wider public as to what 'zero-carbon' homes really mean for the user, as this reporting will likely expose a lack of benefit.
- The provision of this data would in theory help the industry to better understand the difference between predicted and actual building performance (such as changes in occupancy and tenant behaviour), help improve predictions and reduce the 'performance gap'. Deviations from planning targets can be

identified and best practice can be extracted and disseminated to facility managers and other industry professionals.

- Whilst the draft policy requires reporting for 'major' applications (e.g. >10 units or 1,000m^2), this still constitutes around 80% of new developments and so this level may need to be adjusted initially. Similarly, the policy also suggests that Display Energy Certificates may provide adequate information within this online portal; however these are known in the industry to be poor indicators of actual performance.
- In practice, there are a number of practical/technical considerations which will need to be outlined before such a system can be implemented. These include:
  - Who will be the governing body for the online portal?
  - Confirmation of metering interval; would the data be half hourly, daily, monthly format etc.?
  - Confirmation of reporting interval; how often will the information be reported?
  - What metrics do we want to be reported? Should regulated and unregulated loads be metered separately?
  - How should multi-occupancy buildings be shown and split out? Can different use types and occupancy levels be shown?
  - What additional infrastructure/metering will be required for this metering to take place?
  - How will domestic and non-residential buildings differ in their reporting requirements? It is likely that obtaining information for the former may be more onerous
  - Will the portal be integrated or linked to the smart meter roll-out?
  - What will be the output? Is there value in a single label or score metric similar to your credit score?
  - Should data be provided directly by energy suppliers? This would provide a level of robustness and consistency which may not be possible if left to individuals to upload.
  - Are there any data confidentiality issues? This will likely not be the case for the majority of users, but an allowance for this eventuality may be required. What data (if any) should and should not be made available to the public/ industry? This is an issue already managed by schools when reporting on energy use.
  - Could this data be exploited by energy companies or others? What safeguards need to be put in place to prevent this from happening?

  - When should reporting begin? At handover, or 6/12 months later when systems have been tested and settled?
  - What are the penalties for not reporting? Should they be named and shamed?
  - Should there be penalties for under-performance? Maybe a restriction on sales/new lettings after an initial grace period (similar to MEES). This could raise further questions regarding apportioning blame and responsibility. Who is to blame for poor performance after handover?
- Discussions also included examples from Australia where buildings are targeted to be zero carbon and performance modelling has improved accuracy. Here, a developer lodges a Commitment Agreement with the government to empower them to market a building with a committed NABERS target – and that is significant for the market there. The performance target and process is included in contractual documentation. NABERS rating performance failure is treated as a contract defect, and typically the contractor will rectify it. Such events are rare as developers set conservative targets. In the UK, there is the opportunity for developers to lodge a Commitment Agreement with the planning authority, so energy monitoring data after occupation can be compared with targets.
- In the US, California and some other States require electric and gas utilities to maintain records of the energy consumption of all the non-residential buildings they supply, and to upload this monthly data to the Energy Star Portfolio Manager platform, following one-off authorisation from the customer.

Recommendations for the SPG

- The participants agreed that the London Plan policy wording should be general with more detail provided within the SPG; which is more likely to be updated regularly. Further detail should be contained within a guidance document on how the reporting should be undertaken (data required, format, best practice, metering examples etc.) and regulated.
- While the policy currently suggests the use of Display Energy Certificates (DECs), this is not recommended. A DEC is the

established operational rating for non-residential whole building performance and is especially suitable for buildings with a single occupier. In order to provide better reporting and control, base building performance must also be measured and reported along with potentially individual tenant ratings, to give each party the data they need to take responsibility for the energy uses they are able to control directly (as is enabled by NABERS in Australia).

- Clarification should also be provided on when the information should be provided e.g. within a specific reporting window or continually. The SPG should also clarify the penalties associated with not reporting.

Recommendations for policy wording

- The following recommendations were considered for the policy wording:
  - The policy should be more committal on the language used in policy 9.2.10. This should state "Demonstrate how…" not "proposal how…".
  - The term 'zero-carbon' developments should be better defined and language provided to demonstrate a shift to zero-carbon in use also.
  - The reference to 'Display Energy Certificates' should be removed as it is too specific (only applying to non-domestic schemes) and does not on its own provide sufficient information to be useful. Instead this could be replaced with more general words such as "a robust recognised methodology" which can be defined more precisely within the SPG. It is also recommended that the wording be revised to capture the benefits of measuring both base building performance (e.g. an LER) as well as whole building performance (DEC), to use the NABERS vocabulary. Although DECs are sufficient for single occupier buildings, they produce very limited agency for buildings with multiple tenants.

  - Further details should be made available as to when this requirement would come into force and how it should be phased in.
  - Participants suggested that five years was not a sufficient time frame for monitoring. Once a scheme is registered onto the system there is marginal cost associated with continuing to report/monitor for an extended period.
  - It is proposed that monthly data be provided (not just annually), with reporting annually as a minimum.
  - Also suggested is that a development must be mandated to store information for a minimum number of years in addition to the requirements for the online portal.
  - Confirmation on the definition of 'major developments' is required.
  - In order to facilitate this monitoring, smart meters must be installed for all new developments which allow for automatic monitoring/reporting.

What information should be input and displayed on the online portal for everyone to see

- A simple rating system for quick building comparisons.
- Reporting of energy in terms of kWp, kWh and tCO_2 in absolute values as well as per m^2 and per person. This should be split by fuel type and include typically electricity, natural gas and water.
- Monthly data should be provided.
- A single point of contact for each development.
- Open access to the public.
- Optional registering of minor applications as well (e.g. beyond compliance).
- Sub-metered data (regulated/unregulated).
- Sub-metered heating and cooling.
- Generic building data (occupancy, use etc.)
- Data to be provided automatically via the energy supplier.
- Scheme to be extended to existing buildings as well in the long term.
- Building relative cost savings.

Examples of how energy demand monitoring can be put into practice for different building types

- Some examples include: Australian NABERS, Passivhaus, Yale University, Bath University, Californian Universities, FM perspective on monitoring, Carbon Buzz.

3 – Heating Hierarchy

Discussion - what is the purpose of the heating hierarchy?

The notes below represent what the group thought the purpose was in its current format rather than what the purpose should be.

- The purpose is to create a centralised approach that provides clear guidance.
- The proposed hierarchy is a carbon one not an environmental one. For example what happens to other environmental issues including air quality?
- Is a hierarchy necessary with the lower carbon electricity grid?
- Is the hierarchy necessary for new build or is it better for retrofits?
- Do high heat grids rule out other low carbon solutions?
- The hierarchy is intended to provide a ranking so that better solutions move to the top. Suggested options are in order so that designers do not bypass those placed highly by the GLA. The purpose of ranking them in order is to focus on those options which cut the most carbon and fit in with the strategic direction of GLA policy - currently district energy combustion orientated networks.
- Why should the approach be based on a specific technological specification? It does not promote full analysis of the potential options. This could lead to the promotion of out of date technology or techniques and currently does not promote designing the proposed system for future technology upgrades.
- Should there be an assumption that all technologies will improve? There should be planned improvements in the carbon performance of heat networks over their lifetime.
- The approach to support a particular technology is out of date. This was needed ten years ago but not now.

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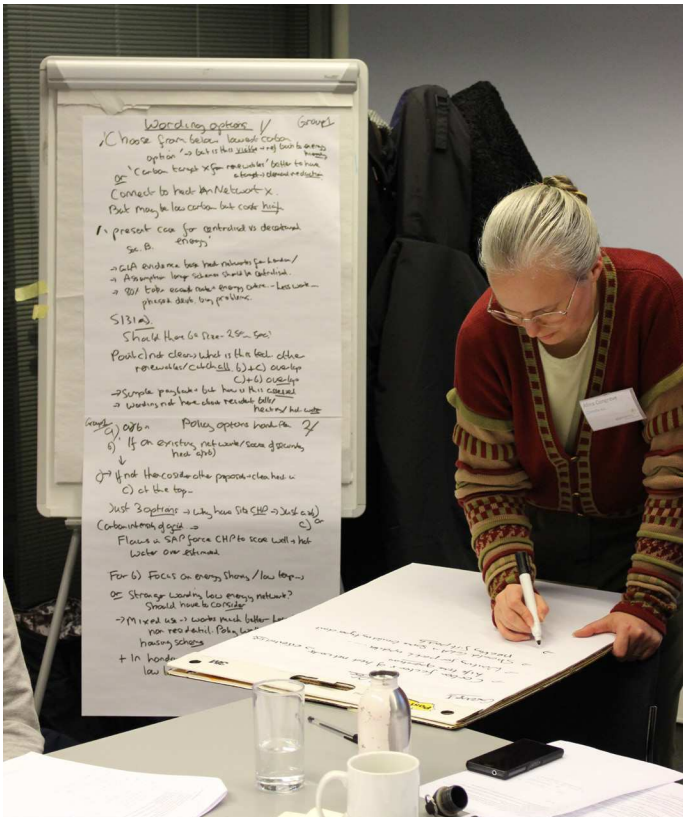
Take four scenarios - what heating systems should be installed in each in order achieve the long-term lowest operational carbon emissions?

- A 20 unit Passivhaus-type residential development:
  - The working assumption was a London apartment building, but in other parts of the country be single family homes.
  - There are issues getting into homes to service the heat interface network. There is no statutory right for access.
  - This type of development does not need a heat network. It is best served by other technologies including solar or air source heat pumps.
  - The cost to residents including potential fuel bills/ maintenance costs need to be considered as well as knowledge implications. For example a CHP could be expensive to maintain, and there is the potential for occupants to adjust the settings which could disrupt water supply to other residents further along the pipes.
  - The main primary heat requirement is for hot water so this should be the main focus.
- An office development:
  - The policy is not very well worded for offices and appears orientated to residential development.
  - Offices need a small amount of heat input at the start of the day but it is more about cooling dominant loads and associated technologies. The hot water load is not significant. A heat pump would be a good solution with point of use electric water heating, but the hierarchy leads you down a CHP route which is high temperature and high heat loss. The focus should be on using electricity as the grid decarbonises. There are issues about the complexity of the system installed and maintenance costs.
- A mixed use development featuring residential, school, office, leisure and retail:
  - Heat transfer and an ambient loop makes much more sense. e.g. a very different type of district energy sharing network again with a move away from combustion on site.
- Predominantly residential-led estate regeneration scheme:
  - The main issue is the long build out time of these projects – 20 years or more. Phasing is incredibly important, alongside system flexibility to change. The scheme must also be socially equitable. Central plant and infrastructure must be modular if it is implemented, and based on performance analysis rather than compliance tick-boxing which often results in systems that are two to four times oversized.



From the points of view of the different stakeholders, assess the limits of the possible outcomes of the current hierarchy

- A developer who is interested in viability, return on investment and liability post-handover.
  - The council should have a strategic plan, it's not up to developers.
  - The policy is mainly relevant for residential developers rather than those dealing with commercial development.
  - Residential developers and their consultants are being forced to govern the delivery of heat networks – their expertise and business model is as housing developers, not infrastructure developers. There could be reputational risks and associated costs to mitigate this if supplies of heating/ hot water were unreliable under a CHP scheme.
  - It is likely that non-operationally focused developers will tick boxes and pass on the issues and risk, which eventually has a negative affect on the occupants.
- A landlord who is interested in sustainability credentials of the building, assurance on future investment, lease/fit out clauses, maintenance/running costs.
  - Landlords are being pushed down a particular route – MEES. Landlords could be concerned their customers are put off the property by a district heating scheme.
  - There is an impact on cost to the tenant. It should not just be about supporting the grid or a network at others' cost. However, in the current market (especially domestic), it will be possible to rent an apartment even if some potential tenants view CHP negatively, as the benefit of having a home outweighs it. In the commercial sector there is even more concern about the tenant. If a commercial property does not have significant hot water use, then the case for CHP or even combustion based heating is not strong at all with good envelope design – in the domestic sector it is critical and raises safety and welfare concerns. There is the concern about high bills if not in control of the network and the role is handed over to a third party such as an ESCo. This can cause reputation risk for a development.
- An engineering consultant/facilities manager who is interested in the long term lowest operational carbon emission and an engineering consultant who wants to use innovative technologies to achieve the lowest long-term operational carbon emissions.
  - It is additional, often unappreciated, work to put together the case for anything other than CHP. The

alternative compliance routes are also not representative of real carbon, energy or technology data profiles.

- Without long term full option and carbon appraisals, the easy option is to head for district CHP. This also does not encourage the district energy providers' to improve or look forward themselves. Fundamentally, this does not promote innovation or free thought.
- There is a lack of information on alternative heat sources. Clients are reluctant to be guinea pigs although there are some robust, well-proven alternative options. Developers want to see the cheapest option. There is a perceived risk for consultants who break with business as usual.
- There are impacts on space – risers (positive and negative), radiators size increase etc. all needing more thought, consideration and coordination. The current process has become a tick box exercise eliminating the consideration of further options. The policy wording is not strong enough to promote designers to do better and for them to then convince developers to change.
- Particularly in the commercial sector, agents do not like change from the 'standard' solutions, which can push clients away from being forward thinking and actually hurt the value of the development longer term.
- Lack of real robust cost data is also used as an excuse to hold back change. Often inflated prices are given to systems that professionals and contractors do not understand, which would have little variance if assessed correctly.

Should a heating hierarchy exist for developments that are not within heat network priority areas?

- The wording should promote assessment of the lowest carbon options and the flexibility of those options to be modified to reflect changes in policy and technology over the life of the system/network.
- We questioned whether the hierarchy was (a) appropriate and (b) in the correct order. Should there be a list of compliance guidance options rather than a hierarchy?
  - Proposals should show how they have considered a range of low carbon solutions and prioritise those that have the best long term feasibility and best socio-economic impact in respect to the development
  - District networks do not need to be combustion based.
  - A lot of investment has gone into heat networks and there are interests in maintaining that consistency in some way shape or form, so promotion of ongoing carbon improvement should be necessary under the policy at appropriate intervals.
- The hierarchy is a carbon hierarchy and we are not clear where air quality and fuel poverty feature. Air quality and NOx would be better dealt with in specific combustion district energy design guides or as part of the planning conditions.
  - Integration of the socio-economic effect on the residents of these large outsourced heating provisions should be part of the option appraisals process.
- We questioned:
  - How appropriate is it to new build when zero carbon and combustion is being built in/future proofed?
  - Should the network have to demonstrate how it reduces carbon over its lifetime – e.g. heat pumps, biomass, biomass with CCS?
  - Should the hierarchy be re-ordered – a) and b) swapped around? The local grid may already have waste heat in it. Should c) be first?
- It feels like the wording and policy is currently heavily focused on residential development and must be more flexible and generally inclusive of all typologies.

Are there any other changes that should be made to Policy SI 3 'Energy infrastructure' and associated paragraphs?

- One option is to have a list, the consultant must carry out an appraisal which highlights the lowest carbon option of the development within the context of the site.
- Could a carbon or energy use index (EUI) be included – including both renewables and demand reduction with a realistic assessment of plug load?
- There should be direct mention of the heating and hot water costs to the tenant in policies that require connecting to a particular heat network. Connection could be low carbon but the costs to tenants could be high.
- Include the clause 'present a case for centralised vs decentralised energy solutions' within the design development.
- It is not clear what c) is talking about – what technology is this? Is it a renewables catch all? b) and c) also overlap. Clarity is required.
- Simplify hierarchy to:
  - If a) and b) apply - where there is an existing heat source or heat network, if not then start with c).
  - Just three options - a) and b) together or c).
- There needs to be stronger wording that is supportive of ultra low temperature energy networks which designers should have to consider.

General:

- GLA needs to provide a stronger evidence base about heat networks in London and there success/pitfalls.
- There is the assumption that all larger schemes should be centralised. 80% of projects take the easiest approval route which is an energy centre/CHP. This is less work but in large phased developments causes problems and is heavy on infrastructure.
- Should there be a minimum size of 250 or 500 homes for district energy consideration? Problem with this is developers putting in applications based on or below the trigger points (or splitting them).
- How is payback fairly assessed and who enjoys the benefit?

- THe flaws in SAP that are making CHP schemes score well – hot water and heating demand is often over estimated, inflating the carbon savings and systems in association. A mechanism is also needed to keep compliance analysis up to date with grid carbon factor updates required at much more regular intervals.
- The GLA allows different calculation methods from the SAP but these are penalised with unrealistically poor carbon factors, pushing designs towards CHP. This in association with local authorities not having the technical knowledge to consider anything different, creating a one option approach.
- The policy is currently written for predominantly housing focused schemes and should better reflect large scale mixed use schemes, where alternative district energy networks can have more positive impact.

Does the group have any SPG content recommendations that might cover some of the detail not included in policy?

- SPG to outline how carbon factors for heat networks be calculated for the lifetime of the development.
- Address those building types that can't fit neatly into Part L methodology. Ensure innovation and free thought is promoted.
- The aim of the SPG should be to produce lower carbon outcomes, not to provide combustion focused heat networks at any cost.
- The SPG should give careful consideration to the relative benefits and disadvantages of air source heat pumps vs CHP. This will change over the lifetime the technology is installed for.
- The high level statement about 2050 should be more practically embedded in policy.
- For larger schemes it is critical that an improvement strategy is considered over the life of the development with some level of reasonable future proofing/flexibility.

Note any suggested actions for GLA to support local authorities in implementing policy

- GLA leadership is needed to help with capacity issues in local authorities and their skills.
- The cluster maps/heat maps are out of date at borough level.
- The strategic plans for opportunity areas should not be left to developers and there is a strategic role here.
- There is a lack of technical skills at borough level to review and many schemes are still not reviewed by the GLA.

Examples of projects

- Heman Estate – small housing development in planning. Includes heat pumps as no mains gas.
- A housing scheme where one tenant had a heating engineer who changed the settings, which were then posted on social media and other tenants followed suit. People were then left without heat and that was a clear problem with the legal position.
- Adleston town centre CHP not for profit scheme.

Questions for technical clarification

- S1 3 (c) – some definition around the zero emissions expectations would be of benefit. What is a zero emission source? Does it mean solar water/PV, which is zero carbon if embodied carbon zero?
- Is there a definition of a secondary heat source – river, ground, industrial etc?
- Why is air quality raised in relation to fuel cells? This is an issue for CHP or combined engineer and fuel cell technology, but not sure why it is connected to fuel cells and why fuel cells warrant separate mention.

4 – Demand Management

Discussion - why demand response is important for inclusion in the London Plan

- Demand response typically involves the reduction (but also the increasing or shifting) of electricity demand during periods of high/low demand. For commercial users this may coincide with periods when electricity costs are higher than at other times. The National Grid also offers incentives at a national level to reduce or shift demand during grid stress events.
- However these time-of-use tariffs are not as common for domestic customers (for many a single flat rate is normally applied regardless of when the energy is used). Economy-7 or Economy-10 tariffs are also used to incentivise (by way of reducing electricity costs) the shifting of loads to the night. Whilst this is a form of demand response, further enhanced capabilities are expected once smart meters have become prevalent, with expected increased usage of time-of-use tariffs to better mirror hourly changes in demand.
- By identifying load flexibility early on in the planning of a development, the impact on the local grid infrastructure may be minimised and future opportunities more likely to be exploited, when they become technically and commercially viable.
- Demand Side Response (DSR) is needed for a number of reasons. These can be broadly broken down into three levels; at a national level, at a local energy network level and at the End-user level.
    - National: DSR can aid national infrastructure during periods of grid stress, both daily as well as in response to specific triggers (e.g. sporting or cultural events). It can also help manage transmission faults or power plant

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outages, leading to fewer disconnections across the country.

- Local energy network: managing faults and grid stress is a necessary part of ensuring local blackouts are isolated and resolved with minimum impact. Reducing the local peak demand will also reduce the number of grid upgrades required, removing barriers to development; this would also reduce barriers to further electrification of heating and transport.
- End-user: leveraging and building energy flexibility into a scheme from the early planning stage will allow users to participate in demand response activities, allowing them to exploit an additional revenue stream in the short term. Longer term, as variable energy pricing comes into play, giving users the ability and information they need to manage their demand will help them avoid high peak charges.

- DSR benefits us by reducing the need for extra generation plant and distribution capacity to cope with relatively short demand peaks often provided by plant, which is traditionally high carbon; this measure therefore should typically result in a reduction in carbon savings.
- DSR is also important as currently time-of-use tariffs at different prices are not as prevalent (especially at the domestic scale).
- For commercial users, demand response is often employed to reduce costs by shifting demand away from more expensive periods of the day. Aggregators are also used to exploit specific incentives operated by the National Grid. Providing provision for flexibility further encourages participation.
- DSR is expected to increase in prominence as electricity demand increases specifically due to the switch to electricity for providing heat and through the increased use of electric vehicles.
- Currently there is limited incentive for limiting the capacity of the connection to buildings at the planning stages, leading to over-specification and crowding of the local network infrastructure.
- It was also noted that there is an intrinsic link between the peak demand and base load demand; as such measures to reduce the base load must also be pursued.
- Calculations should attempt to take into account (though it is acknowledged that this has its difficulties) how carbon intensity of electricity changes at different times of the day, and therefore may be less when charging compared to when discharging. This would avoid penalising the use of batteries which are otherwise beneficial to the grid.

What are the methods?

Heating and cooling systems:

- Use of thermal storage such as buffer vessels, ice storage systems (and possibly phase change materials going forward) to shift demand to low demand periods of the day.
- Heat pumps not direct electric results in higher coefficients of performance. Direct electric systems are still favoured by developers due to low capital costs.
- The electrification of heat poses an interesting challenge. This can necessitate reinforcement of grid infrastructure and therefore end up penalising early adopter.

Reducing base load:

- By reducing the base load of the development, the peak load is also likely to be reduced.

Fabric:

- Use of room exposed thermal mass or similar to smooth both heating and cooling peak demands. Note this is not necessarily the case for all buildings and therefore the addition of thermal mass should be carefully considered.
- Examples of the use of additional standards such as Passivhaus plus and Passivhaus premium were presented. In general, the implementation of standards such as Passivhaus and EnerPHit are encouraged.

Grid:

- On-site generating energy reduced draw from the grid.
- Currently few incentives exist for peak demand reduction / limitation day-to-day. Currently balancing services offered by the National Grid are aimed only at the worse stress events.
- Pricing signals can be further explored to reduce peak draw.
- Considerations should be made to the local network and how to reduce local substation peaks in respect to other consumers on the network.

Controls:

- Time-of-use tariffs are expected to increase in use in line with the adoption of smart meters.
- Limiting electricity draw from certain appliances (recent examples include vacuum cleaners and kettles).
- Reduction (at planning stage) of the installer capacity for buildings (e.g. the National Australian Built Environment Rating System).
- Improved control of plant (chillers, heaters, pumps, etc.) and other large building loads would create opportunities for flexibility and demand reduction.
- Using open control standards allows equipment to communicate and be controlled easily, making energy management systems more straightforward to maintain as well as reducing the upfront cost of developing flexibility opportunities.

Storage:

- Use of battery storage
- Fuel cells
- Hot water storage
- Aquifer Thermal Energy Storage (ATES).

Taking learnings from exercise one, consider the key areas for finalising the wording of paragraph g if needed to ensure that the desired outcomes are achieved

- 9.2.10 – g –"Proposals for demand-side response, specifically through installation of smart meters, minimising peak energy demand and promoting short-term energy storage, as well as consideration of smart grids and local micro grids where feasible."

To

- 9.2.10 – g –"To anticipate infrastructure capacity challenges for a growing London, proposals for demand-side response and minimising peak energy demand should be submitted."

Explanation:

The proscriptive measures outlined in the current wording do not in themselves constitute a demand response measure. Whilst smart meters, smart grids and micro grids could lead to a reduction in peak demand, this is not necessarily the case. Caution should be used if developers/installers offer these technologies without the energy management facilities provided once the building is completed and in use. As this industry is fast moving, we have shied away from suggesting alternative examples which could quickly become redundant.

As the London Plan is less likely to be regularly updated, specific details should be contained within the SPG, which is more likely to be revised.

Provide recommendations on the content of an SPG that provides guidance on how to write this demand response statement in an energy strategy

- Lists of suggested building components and measures should be listed alongside both potential and adopted DSR measures:
  - Any adopted DSR measures should consider the effect on 1)national, 2)local energy network and 3)user levels (see earlier explanations).
- These measures may be contrasted against a notional building and must be measurable rather than a vague statement:
  - This may initially be using Part L, but in time may shift to also consider a typical London building of a similar use type once this information is available.
  - Hence one way a planning applicant could show it has satisfied 9.2.10 – g is by demonstration that the building peak grid energy demand does not occur during critical months as defined by the GLA (e.g. Dec and Jan – for existing grid peak, and July and August for future grid peak) using the Part L energy modelling.
  - In future, moving from critical months to smaller units of time (such as critical half-hourly periods in a day) should be considered as better models become available.
- Evidence should be provided that peak demand does not occur during certain summer and/or winter months when infrastructure is particularly constrained. This could be reverted to a percentage reduction once further data is available.
- Energy strategies should require buildings to list annual and peak demand for each month both in absolute and per square metre metric e.g. kW (for both regulated and un-regulated energy) to allow data to be gathered and inform further refinement of this policy.
- A demand response hierarchy may be developed in line with the London energy hierarchy.
- Reference should be made to best practice and specific standards that can be referred to. Example of what good practice looks like.
- Control systems which give end users better access to wider demand response (current and future) should be the norm.
- The capacity and effects of development to the local substation should be discussed.
- Comments should be made on how unregulated loads have been considered. This may include discussions on how to influence consumer behaviour and better targeting.
- Long term effects of these measures should also be considered. In particular the effect of domestic half-hourly billing for domestic users and increase renewables (e.g. wind) during winter months.
- The future proofing of the building may also be discussed. In particular, how vulnerable residents will be protected from market changes, for example the introduction of high cost kWh tariffs during periods of peak grid demand.
- Space should be available within the policy to encourage variety and innovation.

Provide guidance as what support the GLA needs to give the boroughs to evaluate this demand response statement

- Potential use of a DSR hierarchy.
- A clear definition of 'critical periods' where demand response should be implemented (see previous comments), which should be updated over time.
- A clear methodology must be outlined – this will make it easy to enforce while also providing simple recommendations.
- A checklist is one approach, but also has limitations.
- An example should be provided "One way of considering this is…but equivalent methodologies are also acceptable".
- References to standards and accepted calculation methodologies should be made where available.
- Guidance should be made as to how technological changes will be dealt with.
- Simple compliance options may be made available – simple, no regret options:
  - Refer to best practice / Californian building code (which reduces allowable grid demand during peak grid demand months).
- How data will be collected at a borough level and subsequently collated to outline typical profiles and examples of best practice.

5 – Embodied and Whole Life Carbon

Participants

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Mel Allwood - Arup

Rhian Williams - Greater London Authority

Richard Twinn - UK-GBC

Simon Sturgis - Sturgis Carbon Profiling

Zoe Watson - Hopkins

Discussion - why is it important to think about embodied carbon

- The industry is keen to understand how embodied carbon is going to be measured and monitored.
- We believe embodied carbon is a global issue. There is a lot of it and it seems we are not thinking about it.
- There is a general perception that we are not talking about it nor counting it or including it.
- The industry is interested to review what do we know about embodied carbon.
- It seems embodied carbon is the big missing piece. The carbon we use in construction appears not to be accounted for in either building regulations or planning requirements.
- Up to now, embodied carbon has not beenmeasured in policy.
- To achieve operational savings, we need to account for embodied carbon cost. If we don't understand the costs of embodied carbon, how could we talk about carbon savings?
- Embodied carbon is the key ground of the circular economy and how we may be deconstructing buildings in future. From a design and planning perspective, this is an evolutionary jump into the unknown. But actually, that is quite key to start looking into deconstruction and how to make it easier for future generations.
- Maybe the issue is that we don't frame embodied carbon directly, or it is not directly labelled as such. However, all measures on green construction materials; reducing construction waste, monitoring energy and water use on construction sites, all count towards reducing embodied carbon.

- However, the table reached quite an agreement that embodied carbon is not directly measured in the current policy. There was a consensus that we do measure operational energy, but this does not capture embodied carbon.

What elements of a development contain the most embodied carbon?

- At practical completion the biggest single element would be the structure, but if we look over time, it will be the fixture and fittings. Embodied carbon is a whole life cycle issue.
- The majority of CO_2 over the whole life depends on use and type of building.
- Recyclable materials that are not easily recycled will eventually have higher life cycle carbon.
- Elements with most embodied carbon:
  - Skin, façade and structure major elements for embodied carbon.
  - Building services, construction and demolition all impact on embodied carbon.
  - Internal finishes (e.g. paint) required over the life of the building.
  - Structure (big savings up to a certain stage).
  - Sourcing of construction materials (location of source and transport).
  - Production of construction materials. (e.g. concrete, steel).
- It is very context dependent e.g. there will be big differences between low rise housing and high-rise buildings, or housing and high-end fitted-out commercial offices, etc.:
  - Depends on life cycle.
  - HVAC may have high embodied carbon and short cycle, but most of its components are easily recyclable materials.
  - High rise buildings will have more foundations.
  - High end offices will have more kit.

What factors do you take into consideration when calculating Whole life carbon?

- Substructure
- Frame
- Upper Floors, Roof,External Walls
- Windows and External Doors
- Internal Walls and Partitions
- Wall, Floor and Ceiling finishes
- Prefabricated Buildings and Building Units
- Sourcing
- Transport
- Fabrication
- Construction
- Repair/replacement
- Operational energy
- Deconstruction/demolition
- Re-use/recycling
- Reducing first and foremost the amount of materials used
- Life of building: how often a 'material' has to be recycled across the life of the building. - Recommended to use a service life of 60 years

- This London Plan is an opportunity to start measuring and demonstrating embodied carbon. There is the need to start assessing real options.
- There was a suggestion to separate embodied carbon from the energy strategy calculation and report, (GLA said this may not be realistically possible).
- Are there any other methodologies?
  - There is already a guidance on this matter publicly available (EN15978) which seems impractical. The standard is great in principle, but everybody is interpreting it in their own way.
  - There is also a RICS guide: 'Whole life carbon assessment for the Built Environment'.
  - The RICS guidance is attempting to answer all those wobbly bits of interpretation and tell applicants what to do. In practice, in three to five years, hopefully this guidance will be re-written.
- We have guidance, but this is not a planning policy, therefore not enforceable.
- Planning teams struggle with energy policy. Simple guidance is needed for embodied carbon.
- It is important that Lifecycle Boundary Information to be included, as defined by BS EN 15978:
- Clarity on starting point. What is the benchmark?

From the points of view of the different stakeholders asses the extremes of what a development might include in their statement on embodied carbon

- Embodied should not be separated from operational. After all, you are looking at the whole life of the building.
- There is a relation between operational and embodied carbon. These are not separate issues. For example façade performance: the way we design the elements of a façade and its performance in operation and embodied terms are completely interlinked and there must be a form of rewarding the fact of thinking about this. If we bring time to this, we have a whole life picture which is where we should be focusing.
- Interesting question about the time value of carbon. When we take that operational value, if we propose a solution where we use one less structural beam to reduce the embodied carbon, and we compare that for 60 or 80 or 120 years' we are saving that carbon now.
- At planning stage, where there are no builders on board it is difficult to know about the materials that will be used and where they will come from, so the assumptions on embodied carbon are quite considerable.
- However, in the same way that you can do a financial budget, based on assumptions, you can also do a carbon budget, by making assumptions and using scenarios.
- If you have operational carbon, at planning committee you get an energy statement saying this is what we think the operational energy is going to be. If you deviate from this, you need to resubmit. But with embodied carbon, if you commit to a strategy and then deviate from it, would you be expected to resubmit for the planning committee to reconsider?
- This could be a two-stage process. The first stage, in any development plan, features a statement where people should be calculating possible embodied carbon in accordance with the RICS guidance. The second stage would be in a few years' time, when applicants will need to go back to their proposed target zone or have a similar policy to operational energy otherwise people must provide information. But an aim to start

this straight away would probably be a big ask.

- What we need is more confidence in embodied carbon and whole life carbon assessment. Consistency in reporting is required.
- How to calculate bottom-line embodied carbon?
- Time span RICS guidance assumes 60 years for a building and 120 years for infrastructure.
- An owner occupier is thinking long term whilst a lot of developers focus on the short term and have different priorities.
- Tenants may demand environmentally friendly buildings. How much would that cost?
- Project teams change through project stages.
- Initial embodied carbon strategy, then the project deviates from it.

Are there any other changes that should be made to the embodied carbon wording?

- Embodied carbon should be counted at design and construction separately over the life of the building.
- Comment to the planning guidance - it needs to have something about what scheme should be used to demonstrate embodied carbon.
- Nothing in the policy in relation to embodied carbon at the moment.
- Energy hierarchy is about of energy use. Where is the embodied carbon?
- SI 2 is not intended to be related to embodied carbon, SI 7 is.
- Sentence K could be brought into SI 2?
  - K should be in SI 2 and this must introduce a methodology for embodied carbon OR
  - K should relate directly to SI 7.
- There is some degree of ambiguity in the policy.
- It would be clearer if SI 2 either introduced a methodology to account for that construction carbon and whether that is site carbon or embodied carbon.
- SI 7 is circular economy. SI 7 is the wrong place for embodied carbon because circular economy is more about general recycling.
- Embodied carbon is about minimising greenhouse gas emissions.
- For a new building, the anticipated lifetime for resources is going to be more embodied than operational.
- Net zero talks about operational energy but we need to know the embodied consequences of achieving net zero carbon, and therefore developers need to put in proposals to minimise the embodied carbon over the lifetime of a building.
- SI 2 should be separated so there is an operational and embodied (or construction and demolition) life cycle.
- This policy shall aim to collect data over time and then after sufficient amount of data has been collected, set benchmarks and future targets.
- It seems there was a consensus that embodied carbon should be part of SI 2.
- Could we ask for the assessments to be at the early stages of the planning subject to assumptions, and then updated at post-construction?
- Should embodied carbon be in policy SI 2? Table agreed yes.
- Include it in a form which is not necessarily about targets but is about doing it (reporting data).
- K Proposal 1: "Referable schemes should undertake nationally recognised embodied carbon assessment and demonstrate that reductions of the carbon impacts of the built asset has been implemented and set out through the design, construction, service strategies and future demolition plans". This would go in SI 2 as E.
- K Proposal 2: "A calculation to report and provide proposals to minimise life cycle carbon".
- Address embodied carbon either more comprehensively with methodology in SI 2 OR take out of SI 2 and address in policy SI 7.
- Policy does not require measure of embodied carbon. We need to require strategic development to undertake embodied carbon assessment in policy guidance for others.
- Embodied should be separated from operation due to complexity of assessment.
- Policy SI 2: Remove "Construction" from A. Introduce an "E" separately for construction.

Recommendations for the SPG

- Whole life cycle assessment.
- Simple guidance (e.g. measures to reduce embodied carbon, expected lifetime of the building, embodied foot print, baseline embodied carbon). This could be easily assessed, easily understood and shows thought has been put into this issue.
- Benchmarks, minimum and maximum embodied carbon, but not this detail for planning.
- Operational energy measured as an anticipation for the future.
- The point about embodied and the life cycle is that you are now asking the same thing, this time with embodied.
- Put side by side the future operational and future embodied carbon. A question for operational carbon has already been made, this would be asked about embodied carbon as well.
- Make assumptions and write them down e.g. what the building is capable of being in the future.
- Ability of the development to do the right thing (the plan you're putting in is the sort of plan that would last 15 to 20 years, indicating the choices you have made at that time of submission).

- 60 years' lifetime / timber 500 years (this is given).
- How often will you be changing the services (equipment/ plant)?
- How often are you replacing the façade? What kind of materials will you be using? Are you choosing the more expensive, higher quality materials that will last longer? Or those that would need to be replaced more often?
- Do you think something is needed that is beyond the RICS Document?
  - RICS document may be too onerous for small developments.
  - The RICS guidance has an entry level. Reduced scope.
  - If the referable scheme is forced then the requirement will impact a lot of the main contractors, and so subcontractors have to start looking at this, which will drive change even if you are not covering a lot of the details.
- What would the policy be trying to do? Finding out the information? Or trying to create a big change in the decisions people make? Probably both.
- First create a market place by asking questions about embodied carbon. These will give an indication on where we currently are.
- Second find out about best practice and data about embodied carbon data.
- Next steps would be to set a benchmark and future percentage reduction requirements, something like operational carbon.
- What we need to target with embodied carbon is resource efficiency.
- Measuring embodied carbon is cost effective in the long term.
- Dismantling could generate a secondary market.
- Economic logic when measuring embodied carbon.
- By requiring people to measure embodied carbon, people will learn that this is actually a positive in their life and then it will become a behavioural change for the good.
- No need to have a benchmark or target yet.
- Looking at the supply chain, often the cheaper option is the environmental one, if we create a supply chain now, by the big schemes, that does have a knock on down the line, which will mean that the next situation when we deal with major developments, then probably the industry would not push back. Because they would have the supply chain already there and they will understand what are we asking.
- Sourcing material from abroad. Distance of travel shall be captured. Ship is much better in terms of carbon foot print in comparison to a lorry as long as it is near the cost in China.
- The table agreed that the industry have a guidance to work with (RICS. What was controversial was the scale of project this should be applied to.
- Do the right thing, calculate embodied carbon in the supply chain.
- Validate the embodied carbon design intent against the actual embodied carbon in construction (this may be of significant cost).
- Validating the design intent is a much more expensive and valuable process than the initial process of going to planning with a simple data sheet. Asking a small unit to do RICS is a substantial ask.
- Taking the issue further, making sure that embodied carbon is validated in construction, this has never been done before.
- Asking stage by stage validation is a significant ask.
- Referable projects should implement the standard (RICS guidance).
- Initially make assumptions at stages 2 and 3 based on the cost plan information and then as you get further down the line, when the architects have chosen the materials, then the assumptions may change.
- Embodied carbon details won't be known until later stages.
- Ask for embodied carbon on referable schemes.
- Embodied carbon software packages out in the market can give you basic numbers.

Recommendations provided by Architype- by correspondence

- The SPG must set out scope boundaries and a reporting framework so that it is clear what elements of life cycle carbon have been included.
- Where Carbon-LCAs are required (for referable schemes) these should be carried out in accordance with BS EN:15978 as a partial Carbon-LCA with the following minimum scope boundary, and for a reference service life of 60 years:
- A1-A3 Product Stage
- A4 Transport
- B4 Replacement
- B6 Operational Energy Use (taken from Part L compliance)

Construction has been excluded as this is hard to quickly quantify and is generally not covered in EPDs. Dissasembly has also been excluded as data on this is vary varied in EPDs and hard to predict. We believe this would be beyond the ability of the profession generally. Alternatively you could specify one scenario e.g. all products are landfilled, or you could reference WRAP data for likely end of life scenarios.

- Additional Elements and Lifecycle Boundaries can be declared but should be itemized separately. A reference service life other than 60 year can also be declared in addition to the 60 year reference service life.

Guidance for GLA support for embodied carbon statement

- Online calculator tool
- Benchmarks for future.

Embodied carbon summary:

- There is an industry standard approach to calculate the embodied carbon. EN15978 which RICS have written guidance on: RICS whole life carbon assessment for the built environment. (table agreed that this method is good but there are a lack of input values to use with this methodology).
- Currently we do not have sufficient data to set embodied carbon targets. The overall aim of the policy should be to get people to report on carbon quantities so that targets/benchmarks can be set in the future.
- Embodied carbon relates to SI 2 not SI 7. It was suggested additional words to go in here. Policy to apply to referable schemes. This will drive benchmarks. The EN guide is currently too onerous for small schemes.
- Our recommendation is to consider Whole Life Cycle Carbon in parallel to Operational Carbon within policy SI 2 as both are complex issues on their own and key to achieving Net Zero carbon buildings.

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