Energy performance targets for net zero carbon offices: Technical report and summary of consultation responses

June 2020
(initial release May 2020)

Acknowledgements

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Contents

1. Introduction

The UKGBC *Net Zero Carbon Buildings Framework*[1] was published in April 2019 following an industry task group and extensive consultation process. The framework sets out high level definitions for net zero carbon buildings covering emissions from both operational energy and construction. It acts as guidance for achieving net zero and will be further developed to include detail and stricter requirements which can be integrated into the framework over time. This will increase the level of ambition needed and challenge the industry to mainstream leading practice.

The first extension to the framework was the energy performance targets for commercial office buildings as this was highlighted by industry as a priority topic. The targets are intended as a minimum energy efficiency target for buildings seeking to achieve net zero carbon status today, using a trajectory consistent with the performance levels that all buildings will be required to achieve by 2050.

This paper summarises the six month development process for energy performance targets for net zero carbon offices. A summary report *Net zero carbon: energy performance targets for offices*[2] was published in January 2020 setting out the headline targets which add additional stretching requirements to the *Net Zero Carbon Building Framework*. This technical report should be read in conjunction with the summary report and outlines further background on the development of the targets. It includes discussion of the 'Paris Proof' methodological approach to the targets, the trajectory and interim targets and an outline of how the targets should be used alongside the Net Zero Carbon Building Framework. It also provides a summary of the consultation proposals and responses, and updates to the final approach based on this feedback.

2. Development process

- In July 2019, UKGBC convened a working group of industry stakeholders well versed in analysing the energy performance of offices. The group comprised representatives from BBP, BPF (Iceni), Arup, Carbon Credentials, JLL, TfL and Verco. The group fed-in to the development of an initial paper for public consultation and collaborated on updates based on the responses received.

- From October to November, UKGBC opened a public consultation paper alongside a questionnaire to gain industry feedback on the proposed approach. An outline of the consultation proposals and outcomes is included in section 6 of this report and a full summary of the 21 responses received is included as Appendix A.

- In December, the working group re-convened to analyse the consultation responses and agree upon final updates. The updates made are outlined in section 7 of this report.

- In January 2020, the summary report *Net zero carbon: energy performance targets for offices* was published as an addendum to the net zero framework.

[1] UKGBC (2019), Net Zero Carbon Buildings: A Framework Definition: https://www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition/

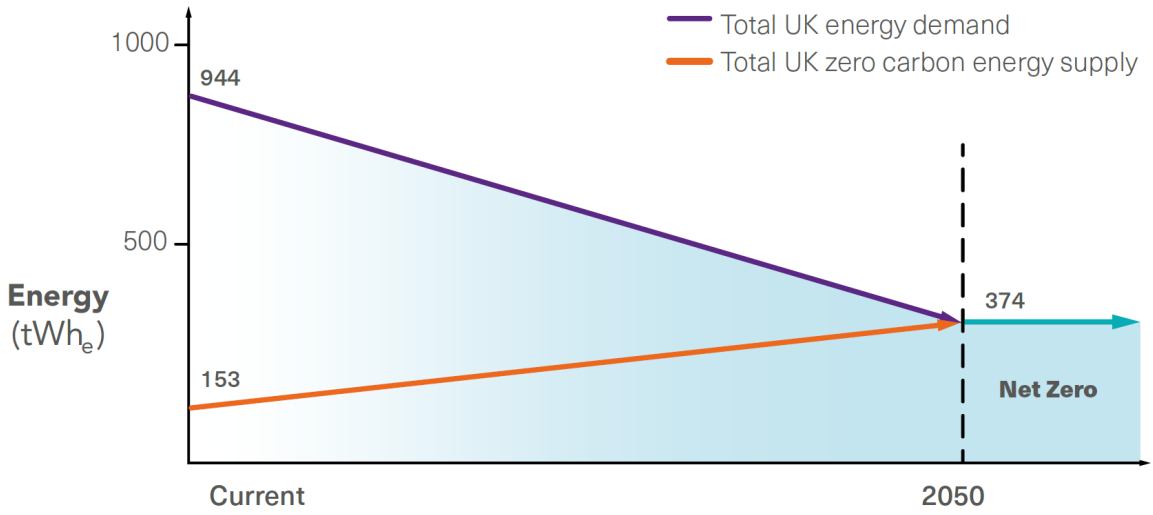
[2] UKGBC (2020) Net zero carbon: energy performance targets for offices: https://www.ukgbc.org/ukgbc-work/net-zero-carbon-energy-performance-targets-for-offices/

3. Paris Proof concept

This project developed energy use intensity targets based on the 'Paris Proof' concept developed by the Dutch Green Building Council.[3] This is based on the scenario in which a net zero carbon economy in 2050 is fully powered by low carbon energy supplies, including renewable energy and nuclear energy. This can only be achieved when the required energy demand is met by the available supply. Current low carbon energy supply projections predict that there will be a shortfall unless energy efficiency measures are applied to reduce overall demand.

The 'Paris Proof' targets set out the expected magnitude of energy efficiency improvements required by 2050 and how this translates to the office building sector.

Figure 1: *In 2050, the UK's total energy demand will need to be supplied by low carbon energy*

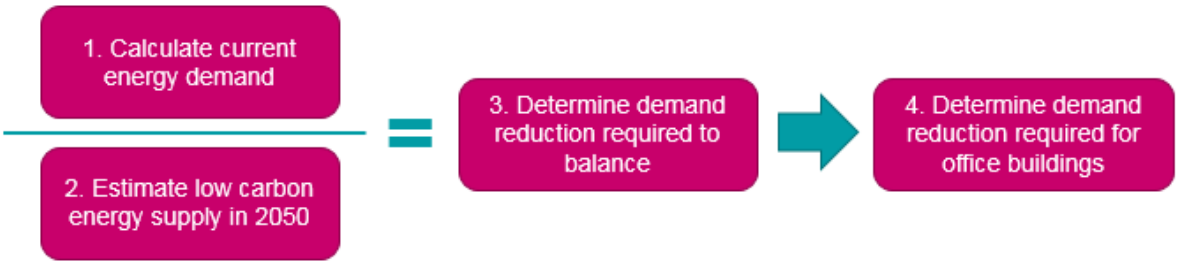


The Paris Proof approach uses a top-down calculation based on the estimated capacity of low carbon energy supply available in 2050 and the allocation of this capacity to different economic and built environment sectors. The 'fair share' of energy can then be allocated at an individual building level to determine an energy use intensity target - a building's maximum annual energy consumption relative to its floor area. This target can also be translated into an equivalent energy performance rating to provide a more robust measure tailored to different types of office buildings.

In this way, the Paris Proof concept has the potential to offer simple and clear targets for individual buildings that are aligned with the transition to a net zero carbon economy. The Paris Proof method involves four steps, set out in Figure 2.

[3] Dutch Green Building Council (2019), Paris Proof: https://www.dgbc.nl/themas/paris-proof

***Figure 2**: Paris Proof methodology*



There are clearly a number of variables and uncertainties in using this approach. These include the amount of low carbon energy supplies available to the UK in 2050, changes made to remove current decentralised use of fossil fuels for heating buildings and transport, and other trends and changes in the demand for energy across the economy.[4] Nevertheless, for organisations seeking today to demonstrate their internal climate policies are consistent with the net zero target for 2050, it is possible to make reasonable assumptions which allow plausible targets to be set for different types of buildings.

The power of this approach is its clarity in showing how energy efficiency is a critical component of any net zero scenario for countries not blessed with surpluses of low carbon energy supplies, and that it quantifies plausible targets at the individual building level. It aims to square the circle between net zero carbon and "nearly zero energy", dealing simultaneously with the notorious rebound effects[5] which can sabotage energy efficiency efforts.

Whilst the focus of this project is on developing targets for commercial offices, the Paris Proof methodology also provides insights into the development of energy use intensity targets for buildings in other sectors. If the approach is successful for the offices sector, this could provide the basis for developing further energy use intensity targets for other sectors that can be then integrated into the Net Zero Carbon Buildings Framework in the future.

The following headings set out the Paris Proof methodology, based on the four steps above.

1) Calculate current total energy demand for the UK

The first step to assuming an economy fully-powered by low carbon energy is to convert the amount of energy currently consumed to electricity i.e. convert all current fossil fuel use to kilowatt hours of electricity equivalent (kWhe). Government sources for current energy consumption and conversion to kWhe are provided in Table 1 below.

[4] Further considerations also include diurnal and seasonal variations in demand requiring the use of energy storage. This will mean that the total supply will need to match the total demand plus inevitable storage losses.

[5] The rebound effect occurs when energy efficiency measures are put in place and, as a result, energy users increase their demand with the perception that their increased demand is made allowable by the efficiency measures. This might even result in more energy being used when compared to before the efficiency measures were put in place.

***Table 1**: Total UK energy demand by use, 2017*

Energy carrier	TWh 2017	TWhe 2017	Statistical source
Gas consumption by final users	495	198	Energy Trends, ET_4.1
Electricity use	322	322	Updated energy and emissions projections, Annex J
All petroleum used by transport	684	274	Energy and environment: data tables, ENV0101
Other petroleum use	259	103	Energy and environment: data tables, ENV0101
Solid fuel	118	47	Energy Consumption in the UK, ECUK1.10
UK total		**944**	

To roughly calculate the kWh/kWhe conversion from current fossil fuel uses, fossil fuel energy is multiplied by 0.4 (as per column 3 above). A rationale for use of this metric is outlined in section 2.3 of the report *Issues considered in developing the LER*[6] developed by Verco for BBP.

These figures cover all current energy uses in the economy, including non-electricity uses. Using the Paris Proof methodology, it is a working assumption that all sectors in the economy will be electrified and powered by low carbon energy e.g. transport, industry, buildings.

Additionally, it is assumed that the proportion of energy currently available to each sector, including the office building sector, will remain the same between now and 2050. This is on the basis that any economic growth to 2050 will be compensated by energy efficiency through innovation in technologies. This addresses unknown future variables e.g. increase in office floor space due to economic activity, reduction in office floor space due to automation. The current total energy demand for the UK economy is therefore calculated as **944 TWhe.**

2) Estimate total low carbon energy supply in 2050

The next step is to estimate the amount of low carbon energy that will be available in 2050.

The BEIS publication *Updated energy and emissions projections: 2017*[7] provides estimates of total electricity generation by source from 2008 to 2035. The projections for renewable energy are based on historical rollout rates and expected increases based on planning consents and industry development pipelines driven by and the current (2017) policy framework. Extrapolation of the trend for renewable energy generation from 2035 onwards predicts 261 TWh by 2050 from 192 TWh in 2035. In addition to this, the 2035 value for nuclear energy is 113 TWh (from 57 TWh in 2018). Assuming no increase in nuclear

[6] BBP (2013), Issues considered in developing the LER: http://www.betterbuildingspartnership.co.uk/sites/default/files/media/attachment/Verco%20LER%20issues%20report%20Final.pdf

[7] BEIS (2018), *Updated energy and emissions projections: 2017* https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017

from 2035 to 2050, these figures suggest a total UK low carbon energy supply of **374 TWh** in 2050. This also assumes that the UK will not be a net importer of low carbon electricity.

The Committee on Climate Change *Net Zero Technical Report* sets out a cost-effective route to net zero based on the likely demand for energy and meeting this through additional low carbon generation capacity. Low carbon generation includes renewables, nuclear, gas CCS as well as other minor sources such as BECCS. The projections account for the electrification of a number of sectors, creating increasing demand on the electricity system. The central scenario presented by the CCC estimates a total low carbon electricity supply of 645 TWh in 2050.[8] This estimate is arguably aspirational to secure the net zero objective, being based upon the likely demand in 2050, but it nonetheless provides an indicative figure for the economically optimum low carbon energy generation capacity.

3) Ratio between predicted supply in 2050 and total demand today

Using the calculated estimates above, it is possible to determine the ratio by which the economy will need to reduce energy demand by 2050. Based on the more conservative BEIS projections (374 TWh in 2050), it implies that low carbon electricity capacity will only be able to meet 39.6% of current demand across the economy. This implies that the office buildings sector will need to reduce its energy demand by around 60%, requiring almost double the efficiency savings compared to the CCC scenario[9].

***Table 2**: Summary of 2050 supply and demand ratios*

Total current energy demand	944 TWh
Total low carbon energy supply in 2050	BEIS projections: 374 TWh
Percentage in energy demand reduction required	(944 - 374) / 944 = 60.4% 60% (rounded)

4) Determine energy use intensity reduction required for offices

The final step in this methodology is to determine a reasonable level of energy demand reduction required for offices, given the aggregated energy demand reduction required across the entire economy. In Table 3, the option recommended by the consultation is expressed as a percentage reduction in line with the ratios outlined above and has also been translated into Display Energy Certificates (DEC) ratings, NABERS star ratings and indicative whole building energy use intensity targets for Net Lettable Area (NLA) and Gross Internal Area (GIA) [10].

[8] Committee on Climate Change (2019), *Net Zero – Technical report* p.21 https://www.theccc.org.uk/publication/net-zero-technical-report/

[9] Discussions with officials at the CCC emphasised limitations in both the demand side of their models (what level of energy demand reduction by energy efficiency will be cost effective by 2050) and the supply side (for example the financial viability of off-shore wind as requirements to increase supply push developments into deeper water, more hostile environments, further from the shore). The 645 TWh/year in 2050 supply/demand balance point is their current estimate for the economic optimum and incorporates a 30% demand reduction by the offices sector. It was noted that the office sector may have more opportunity than other sectors for greater reductions than currently assumed.

[10] See section 6 (page 12) for the consultation proposals and outcomes.

***Table 3**: Paris Proof targets for commercial offices*

Percentage energy reduction	60%
DEC rating (whole building)[11]	B40
NABERS rating (base building)[12]	5.5 stars
Energy use intensity, for: kWhe/m^2 (NLA) / year kWhe/m^2 (GIA) / year	 72 57

4. Paris proof targets and trajectory

For offices looking to achieve net zero carbon for operational energy, the Paris Proof targets offer an outcome-based approach to setting energy performance targets. The energy performance targets work in tandem with the net zero framework, where any office claiming to be net zero must demonstrate in-use performance on an annual basis.

While the Paris Proof approach offers a single outcome target for 2050, a consistent point of feedback from the consultation was the need for interim targets, thereby setting out a trajectory towards this long term objective. This would provide greater clarity about what should be required of buildings that are seeking to achieve net zero carbon today, following the process set out in the net zero carbon buildings framework.

In response the working group set out a trajectory of targets over the next fifteen years for individual assets seeking to achieve net zero. The levels are deliberately challenging to ensure that offices claiming to be net zero are demonstrating leading practice in the market. Figure 5 sets out a trajectory for tightening performance targets over the next fifteen years and Table 4 outlines the detailed figures.

2020-2025

Taking the principle of a DEC rating of D100 as the current median for the building stock, the initial target for 2020-2025 calls for a 10% reduction on this level to DEC D90. Whilst data for the offices sector is incomplete, this level represents a 5% improvement over 2019 good practice levels from the REEB database[13]. On the other hand, for public buildings the DEC database indicates that the average performance from 2016 was already at DEC D80, meaning the majority of public office buildings should already exceed the 2020 target. As such, we expect that the 2020 target will reflect roughly the top 10-20% of energy performance in the current office stock.

[11] A DEC rating of D100 represents, in principle, the median whole building energy performance rating of the existing building stock. As DECs use a linear scale, a percentage reduction across the existing building stock will result in an equivalent shift in the median DEC rating e.g. a universal 30% reduction would reduce the median to C70.

[12] The NABERS rating system assumes the current commercial office stock median rating is approximately 3 stars.

[13] When the targets were set in late 2019, they represented a 15% improvement over 2017 REEB good practice covering measured data for 2016-17 which was available at the time. In March 2020 the REEB 2019 database was released covering measured data for 2018-19, over which the targets represent a 5% improvement.

2025-2030

From 2025, buildings seeking to claim net zero will need to achieve a step change in energy performance down to DEC C65. This provides an opportunity for building owners to make plans for more significant improvements and should coincide with increased interest in reducing in-use energy performance thanks to proposed legislation from government for mandatory operational ratings for commercial buildings.

2030-2035

From 2030, net zero buildings should seek to align with the Government's Clean Growth Grand Challenge Mission to halve the energy use of new buildings and to halve the costs of retrofitting to the same level by 2030. In this way, the net zero targets will provide an additional incentive for the industry to drive investment and innovation towards the Mission outcome. The 2030 whole building energy targets anticipate substantial improvements from today in lighting and IT efficiency, and also a continuation of the trend for on-site servers in offices to be migrated to the cloud.

2035-2050

From 2035, assets seeking to claim net zero carbon should already be achieving the 2050 Paris Proof targets. All buildings will need to be net zero carbon by 2050 but the trajectory of targets means that the definition of 'net zero' will change over time. From a carbon mitigation perspective, it is therefore vital that 'net zero' buildings should align with those needed in 2050 as soon as possible, without the need for future retrofitting. 2035 is viewed as the earliest possible date at which the 2050 targets could be practically achieved by a minority of office buildings.

Figure 5*: Trajectory of tightening energy performance targets*

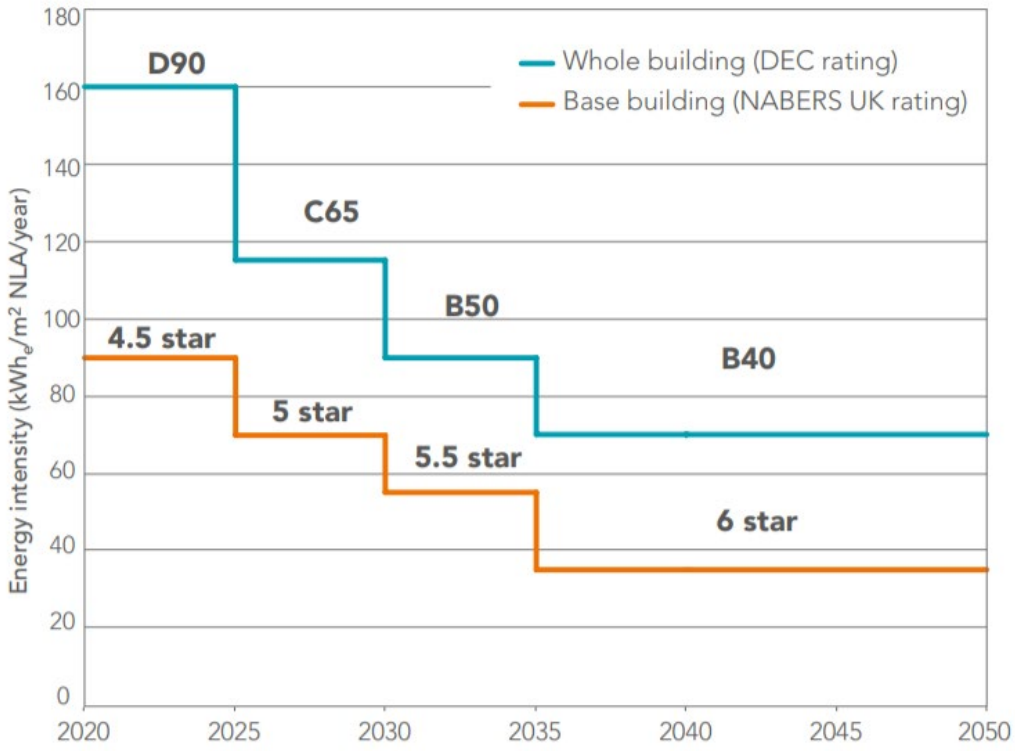


***Table 4**: Paris Proof and interim energy performance targets*

		Interim Targets			Paris Proof Target
Scope	Metric	2020-2025	2025-2030	2030-2035	2035-2050
Whole building energy	kWh_e/m^2 (NLA) / year	160	115	90	70
	kWh_e/m^2 (GIA) / year	130	90	70	55
	DEC rating	D90	C65	B50	B40
Base building energy	kWh_e/m^2 (NLA) / year	90	70	55	35
	kWh_e/m^2 (GIA) / year	70	55	45	30
	NABERS UK star rating	4.5	5	5.5	6
Tenant energy	kWh_e/m^2 (NLA) / year	70	45	35	35

NLA = net lettable area GIA = gross internal area

The energy use intensity values represent the net import of energy (i.e. net of on-site renewables) and assume an all-electric office. For buildings where other fuel types are used, the weighting factors in BBP's Real Estate Environmental Benchmark[14] should be applied to convert to kWh electricity equivalent (kWhe). Please note, the energy use intensity targets are indicative as they are based on standard hours of use and operation, with kWhe values rounded. The DEC and NABERS UK ratings would allow for extended hours of use and for special uses, offering a more tailored approach to individual offices.

Whilst this is clearly an extremely challenging outcome to achieve within the next fifteen years, the scale of ambition outlined is representative of the scale of the transformation needed from the sector over the next thirty years. This will require a radical shift in the way that offices are designed, built and operated over the next thirty years, embracing both new technologies and new ways of working.

[14] Better Buildings Partnership (2019), Real Estate Environmental Benchmark [online], available at: www.betterbuildingspartnership.co.uk/real-estate-environmental-benchmark

5. Use of targets with net zero carbon buildings framework

The Paris Proof targets were specifically developed to provide the industry with guidance on the expected levels of energy performance for commercial offices seeking to achieve net zero carbon in operation. The calculations are based on current assumptions for the predicted supply of renewable energy at the economy-wide level ('top-down' calculations) and current industry consensus, thereby making them inherently variable. Future studies, including those undertaken by Design for Performance Pioneer projects and LETI, should aim to better understand the viability of design and operational changes required for offices to achieve these targets ('bottom-up' calculations).

The consultation responses (outlined in Section 6) indicated a preference for the most ambitious targets to be used and, in future, if industry consensus changes based on updated assumptions for future renewable capacity, these targets may be relaxed. In the absence of more definite projections for the next 30 years, aiming for more stretching levels of energy performance is the least risk averse option for being net zero carbon ready in the future.

The targets should be used as a guiding figure for new development projects, and for whole building refurbishment or energy efficiency measures for existing buildings. There are two main ways in which the targets should be used in conjunction with the framework:

Assets

Individual assets claiming net zero carbon status should represent leadership in the market. As such the trajectory of targets should be followed as the first step in the net zero hierarchy for energy performance. A building achieving these levels of in-use energy performance should then proceed to achieve a net zero balance for operational energy using either onsite renewables, offsite renewable energy procurement, or as a last resort, offsets. The relevant data should be collected in line with the reporting template in Appendix B of the framework (or equivalent certification scheme) and third-party verified on an annual basis, in order to demonstrate the achievement of net zero carbon in operation.

Portfolios

An alternative use of the targets is to use the Paris Proof targets as an outcome for a whole portfolio by 2050. This approach acknowledges that not all buildings can demonstrate leading practice in the short term and will need to be gradually improved over the next thirty years to avoid becoming stranded assets. Portfolio owners could therefore use the final Paris Proof targets as an end-point for the average performance of their stock by 2050, and set out plans for making improvements to achieve this over the intervening period. This would allow improvements to be made in line with existing maintenance and management strategies and should avoid forcing measures on individual buildings which may not be appropriate.

Businesses seeking to take this approach should clearly set out an action plan of improvements they intend to undertake in order get their portfolio up to Paris Proof levels by 2050. Alongside this, they should then follow the remaining steps in the framework – reporting annual energy consumption and achieving a net zero carbon balance using onsite renewable energy, offsite renewable procurement and offsets. This data should be third-party verified annually in order to demonstrate achieving a net zero carbon balance.

This portfolio-based approach aligns with the WorldGBC Net Zero Carbon Buildings Commitment where signatories commit to their portfolios achieving a net zero carbon balance by 2030. The Commitment does not require any Paris Proof targets to be met by this date, but alongside the use of renewable energy (and any offsets) there should still be a long term energy action plan in place for the continual improvement of the whole portfolio up to 2050.

6. Consultation proposals and outcomes

UKGBC published a consultation on Paris Proof targets for commercial offices in October 2019. The objectives of the consultation were to gain feedback from industry on the proposed Paris Proof methodology and on the future energy projections that should be used to determine the targets.

Data source

The consultation paper identified two potential sources for future energy projections which illustrated different scenarios for renewable energy capacity in 2050:

- BEIS (2018), Updated energy and emissions projections: 2017; and
- Committee on Climate Change (2019), Net Zero – Technical report.

BEIS

The BEIS publication *Updated energy and emissions projections: 2017*[15] Annex J provides total electricity generation by source from 2008 to 2035. Extrapolation of the trend for renewable energy generation predicts 261 TWh by 2050 from 192 TWh in 2035. In addition to this, the 2035 value for nuclear energy is 113 TWh (from 57 TWh in 2018). Assuming no increase in nuclear from 2035 to 2050, these figures suggest a total UK low carbon energy supply of 374 TWh in 2050. This also assumes that the UK will not be a net importer of low carbon electricity.

Committee on Climate Change

The Committee on Climate Change *Net Zero Technical Report* sets out a cost-effective route to net zero based on the likely demand for energy and meeting this through additional low carbon generation capacity. Low carbon generation includes renewables, nuclear, gas CCS as well as other minor sources such as BECCS. The projections also account for the electrification of a number of sectors, creating increasing demand on the electricity system. The central scenario presented by the CCC estimates a total low carbon electricity supply of 645 TWh in 2050.[16] This estimate is variable based upon the likely demand in 2050, but it nonetheless provides an indicative figure for the viable low carbon energy generation capacity.

Target options

Given the significant variation in the level of energy reduction required across the economy, the consultation paper set out three different options for the Paris Proof targets for commercial offices. These each represent different levels of ambition for the sector and involve different levels of risk.

The three options are expressed as a percentage reduction in line with the ratios outlined above and have also been translated into Display Energy Certificates (DEC) ratings, NABERS star ratings and indicative whole building energy use intensity targets for Net Lettable Area (NLA) and Gross Internal Area (GIA).

[15] BEIS (2018), *Updated energy and emissions projections: 2017* https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2017

[16] Committee on Climate Change (2019), *Net Zero – Technical report* p.21 https://www.theccc.org.uk/publication/net-zero-technical-report/

***Table 4**: Consultation options for Paris Proof targets for commercial offices*

	Option A (from CCC data)	Option B (from BEIS data)	Option C (compromise proposal)
Percentage energy reduction	30%	60%	50%
DEC rating (whole building)[17]	C70	B40	B50
NABERS rating (base building)[18]	4 stars	5.5 stars	5 stars
Energy use intensity, for: kWhe/m^2 (NLA) / year kWhe/m^2 (GIA) / year	 125 100	 72 57	 90 72

Option A – a 30% reduction based on the CCC cost effective scenario for net zero and presenting total energy reductions needed across the sector. But it also represents the lowest ambition for energy savings of the three options and the highest relative level of risk for investors because it does not account for future unknown variables e.g. relative increases in floorspace by 2050.

Option B – a 60% reduction representing a more conservative estimate based on BEIS projections up to 2035 and extrapolation of these figures out to 2050. These projections were not originally intended to offer a vision for a net zero scenario for 2050 but they do indicate the current level of policy ambition. This option therefore represents the lowest relative level of risk for investors.

Option C – a 50% reduction proposed as a compromise target between the CCC scenario and extrapolation of the BEIS projections as well as taking into account other investment and policy considerations. The Climate Bonds Initiative (CBI) assesses the climate resilience of investments and commonly uses the top 15% of a particular market as a proxy for best practice. A 50% reduction in energy use broadly reflects the top 10-15% of the current commercial offices market in terms of energy performance, and so is therefore consistent with the approach of the CBI. These levels of energy reduction also align with the Government's Clean Growth Grand Challenge Mission to halve the energy use from new buildings by 2030.[19]

[17] A DEC rating of D100 represents, in principle, the median whole building energy performance rating of the existing building stock. As DECs use a linear scale, a percentage reduction across the existing building stock will result in an equivalent shift in the median DEC rating e.g. a universal 30% reduction would reduce the median to C70.

[18] The NABERS rating system assumes the UK current commercial office stock median rating is approximately 3 stars.

[19] UK Department for Business, Energy & Industrial Strategy (2019), The Grand Challenge Missions: https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/missions

Key findings from consultation

This section provides an overview of the three key findings from the 21 responses received as part of the consultation process. For a full summary of the consultation responses, please see Appendix A.

Broad approval of Paris Proof approach

Findings

The overwhelming majority of respondents agreed with the approach in-principle. These respondents made clear that the top-down calculations might act as a catalyst for driving reductions at the asset level, given the awareness of the scale of reductions required across the sector, and that decarbonisation of the electricity grid is necessary but not a sufficient solution for offices.

Some respondents highlighted the sensitivity of the targets based on the estimation of low carbon energy supplies. These respondents suggested that this sensitivity should be balanced with the practical implications for the offices sector.

Despite this sensitivity, the majority of respondents agreed that the offices sector should reduce energy demand to a greater magnitude compared to other harder to decarbonise sectors (e.g. healthcare and education buildings, aviation sector).

Outcome

The final paper makes clear that the calculations are inherently variable and will be revised over time as more information becomes available. Additionally, the 'top-down' calculations have been balanced with 'bottom-up' performance, with the inclusion of current best practice performance as the starting point for the net zero trajectory.

Use the most ambitious targets

Findings

Three options were proposed in the consultation paper for an appropriate Paris Proof target and the majority of respondents (67%) were in favour of the most ambitious. A breakdown of the three options is provided below:

	Votes in favour
OPTION A: 30% reduction Equivalent to: DEC C70; NABERS 4 stars; 125.3 kWhe/m2/year (NLA); 100.1 kWhe/m2/year (GIA) (Target based on CCC projections for net zero 2050)	10% (2 votes)
OPTION B: 60% reduction Equivalent to: DEC B40; NABERS 5.5 stars; 71.6 kWhe/m2/year (NLA); 57.2 kWhe/m2/year (GIA) (Target based on BEIS emissions projections extended out to 2050)	67% (14 votes)
OPTION C: 50% reduction Equivalent to: DEC B50; NABERS 5 stars; 89.5 kWhe/m2/year (NLA); 71.5 kWhe/m2/year (GIA) (Compromise target between CCC and BEIS projections and reflecting current best practice)	24% (5 votes)

Key reasons for selecting the most ambitious target included the high potential for energy reductions in the office sector, helping to safeguard for any uncertainty in the calculations and from other economic sectors not being able to sufficiently decarbonise, and setting a stretching target to counter the 'performance gap' and the fact that not all offices will be targeting net zero.

The CCC projections represent an optimum cost-effective scenario for 2050, however the BEIS projections demonstrate that there remains a significant and growing policy gap to achieve this outcome. Given these uncertainties, respondents to the consultation highlighted the need to take a low risk approach and use the less optimistic projections from BEIS.

Some concern was raised around the difficulty for achieving the targets for different offices, specifically in older buildings where the cost of retrofit is prohibitive and commensurate with embodied carbon impacts. Despite this, most respondents agreed that the focus on reporting in-use energy will help to raise awareness around energy efficiency and drive some level of reductions across all offices.

Outcome The final paper sets the Paris Proof target as the most ambitious (Option A), however with initially relaxed targets that tighten from today until 2035. This is intended to signal to the office sector the level of reductions required so that the targets can be considered as part of retrofit plans and new office designs.

The targets represent the ambition for the average office performance across the sector and do not differentiate between new and old buildings for simplicity. However, the paper does include a note to consider the embodied carbon for any retrofits undertaken to existing offices.

Develop interim targets

Findings A large proportion of respondents, including the technical working group, highlighted the fact that the Paris Proof target in 2050 might be considered too distant for offices to properly engage with and to drive the rapid energy reductions required. There were suggestions for interim targets (5-15 years) to focus efforts and for verification of continued action, in a similar vain to Science Based Targets.

Outcome The final paper includes a 'net zero trajectory' where targets are initially relaxed and tighten to the Paris Proof target by 2035. The initial target has been set close to the good practice performance from the REEB 2019 office dataset, representing the top 10-20% of the office market. This target tightens in increments over every five years to give the market the necessary time to adapt to improved levels of performance.

In addition, for an office to achieve net zero in operation, the net zero framework is to be used to disclose energy performance and demonstrate a net zero carbon balance is achieved on an annual basis.

7. Updates to proposals following consultation

The working group re-convened following consultation to review all responses received and agree upon relevant updates. The rationale for these updates is provided below.

Net zero trajectory

The original approach proposed a single 'Paris Proof' target for 2050, however key findings indicated a preference for interim, 5-15 year targets. The working group developed a trajectory of interim targets that tightens every five years between now and 2035. The initial target has been set as broadly representing the top 15-20% of the office market, which aligns with a similar bracket for current green finance mechanisms[20] and was considered a reasonable starting point for any office seeking to claim to be net zero today.

The energy performance targets work in tandem with the net zero framework, where any office claiming to be net zero must demonstrate in-use performance on an annual basis. The reporting templates from the framework should be used to disclose energy use and demonstrate that a net zero carbon balance is achieved using renewable energy and offsets.

Conversion factors for other fuels

The original approach assumed an all-electric building and did not clarify any conversion factors for other fuel types i.e. on-site gas. The working group agreed that there will be existing offices using gas and that there should be consistency in calculating the conversion to kWh electricity equivalent (kWh_e).

The conversion factors included in the final paper are those used in the Better Buildings Partnership's (BBP) Real Estate Environmental Benchmark.[21] These conversion factors were selected as they were considered the most well-recognised within industry and responsive to any future updates undertaken by BBP.

Base building and tenant energy use intensity targets

The original approach included energy use intensity targets for a whole building only, but not for base building or tenant areas. The working group agreed that to encourage maximum uptake of the targets, a variety of relevant targets should be provided to enable different levels of stakeholders to engage with them.

The energy use intensity targets for base building and tenant areas were developed as a subset of the whole building target, based on standard hours of use and operation and with kWh_e values rounded. The equivalent DEC (for whole building) and NABERS UK (for base building) ratings would allow for extended hours of use and for special uses, offering a more tailored approach to individual offices.

[20] The Climate Bond Initiative generally uses the top 15% of a market to indicate best practice for green bond certification. See: https://www.climatebonds.net/

[21] Better Buildings Partnership (2019), Real Estate Environmental Benchmark [online], available at: www.betterbuildingspartnership.co.uk/real-estate-environmental-benchmark

Appendix A: Full summary of consultation responses

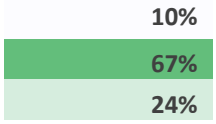
This section provides a summary of the 21 responses received to the eight questions posed alongside the consultation paper (Appendix A).

Question 1	Do you agree with the approach of developing a target using the Paris Proof approach i.e. using projections of low carbon energy supply to estimate energy use intensity requirements?
Summary	The overwhelming majority of respondents agreed with the approach in-principle, highlighting the top-down calculation as a potential catalyst for driving widespread action, including policy change. Some respondents (4) highlighted that the theoretical calculations and target should be balanced with practical implications for industry, including current inertia, high cost of refurbishment, and lack of supportive policy. Some respondents highlighted the high level of variability in the estimation of low carbon energy supplies. One respondent was cautious about including low carbon heat with a suggestion to include only zero carbon energy sources.
Proposed updates	Make clear that the calculations have a high level of sensitivity and that the final target is a 'rule-of-thumb' indicator of the magnitude of reductions required. Also confirm that figures will be updated over time as projections gain greater accuracy - these targets are building on current momentum.

Question 2	The targets proposed in this consultation are based on two main data sources to estimate the low carbon electricity capacity in 2050: (1) Committee on Climate Change (2019), Net Zero – Technical report (2) BEIS (2018), Updated energy and emissions projections: 2017 Do you agree with the use of these data sources? Please specify any additional data sources which you think should be utilised.
Summary	Almost half of the respondents are in favour of further consideration on the validity of the data sources, including: a specific consultation on this, using EUREF 2016 scenarios or updated (2018) BEIS projections, or ensuring figures are updated over time based on more accurate projections. Half of the respondents agree with the sources used, with most preferencing the CCC projections based on the unreliability of BEIS figures (including unknowns around nuclear) and recent 5 year growth rate of renewables (19%pa currently vs. 5%pa required to meet CCC projections). Using the CCC projections would relax the energy target.
Proposed updates	Recognise that the CCC projections may be more accurate, however that there is a current policy gap (based on BEIS) and that significant private investment is required.

Question 3	The Paris Proof approach is based on a number of broad assumptions to establish energy reduction targets, including: (1) The burden for reducing energy demand by 2050 is spread equally across all economic sectors. (2) The economy will move towards 100% electric power, generated by low carbon sources. (3) The UK will not be a net importer or exporter of renewable energy i.e. via international interconnectors. Do you broadly agree with these assumptions? If not, please explain why.
Summary	Whilst respondents accepted there would need to be some level of assumptions made, the majority provided further discussion on those proposed, including: (1) The office sector should decarbonise at a faster rate than others based on: other research studies, greater potential and relative ease of decarbonising compared to other sectors (e.g. healthcare and education buildings, aviation sector), and the high investment capacity in the offices sector. Most of these respondents suggested the 'fair share' for the offices sector was less than its current proportion. Applying this logic would make the energy target more stringent. (2) The suggestion for an all-electric economy is unrealistic based on CCC projections, including gas and hydrogen and the difficulty to disconnect existing buildings from the gas grid. (3) It is unrealistic (three respondents only) for the UK not being connected to interconnectors in the future as it is not reflective of the current energy system and not in alignment with CCC projections.
Proposed updates	Highlight that the office building sector has to decarbonise more than others (this counters the argument around higher projection of renewables).

Question 4	Three options are proposed in the consultation document for an appropriate Paris Proof target for commercial offices: • OPTION A: 30% reduction Equivalent to: DEC C70; NABERS 4 stars; 125.3 kWhe/m2/year (NLA); 100.1 kWhe/m2/year (GIA) (Target based on CCC projections for net zero 2050) • OPTION B: 60% reduction Equivalent to: DEC B40; NABERS 5.5 stars; 71.6 kWhe/m2/year (NLA); 57.2 kWhe/m2/year (GIA) (Target based on BEIS emissions projections extended out to 2050) • OPTION C: 50% reduction Equivalent to: DEC B50; NABERS 5 stars; 89.5 kWhe/m2/year (NLA); 71.5 kWhe/m2/year (GIA) (Compromise target between CCC and BEIS projections and reflecting current best practice) Please select which of the three options you think is most appropriate for use as a target for commercial offices.

Summary	 67% of respondents were proponents for the most ambitious target (60% reduction) on the basis that: • It would help to account for any uncertainty in the calculations and mitigate the impact of the economy as a whole not achieving the 60% reduction, • The target should be stretching to counter the 'performance gap' and the fact that not all buildings will be targeting this, • The target is considered achievable, and • The CCC's projections are seen as optimistic. The remaining 33% of respondents selected less ambitious targets (see breakdown below) with most selecting a 50% reduction on the basis that: • The significant magnitude of the target (60%) may deter stakeholders from engaging with it, and • Given the variability between CCC and BEIS projections, a more pragmatic, mid-way target is appropriate (50%). Clarification was sought on when this target would need to be met (some stakeholders suggested a staggered target i.e. 2030 and 2050) and which buildings this would apply to (i.e. new or existing).
Proposed updates	Opt for a 60% reduction target, clarifying that this will need to be achieved for new buildings and major refurbishment by 2030 and for all existing buildings by 2050. Whilst calculations using the CCC projections (preferred) would allow a more relaxed target, most respondents are calling for a more stringent target based on the high potential for reductions in the office sector. (Need to make clear the final target is based on a more pragmatic approach, less than calculations)

Question 5	Do you think these targets are achievable for new buildings today and for existing buildings by 2050? What do you think are the broad changes required in the office market to achieve these targets?
Summary	The majority of respondents agreed that the targets are achievable for new buildings (with a more supportive commercial and regulatory environment), however much more difficult for existing buildings (due to the complexities of retrofit, including high embodied costs and heritage considerations). Respondents agreed that policy change is crucial to enabling widespread adoption of the targets, ultimately making them standard practice. Some respondents (4) highlighted the need for greater transparency of in-use energy performance as a way of incentivising greater reductions sooner. One respondent highlighted that the priority should be to have all buildings electrified first, prior to seeking energy reductions.
Proposed updates	Highlight that the targets will be more achievable for new buildings today and that the priority for existing buildings is to disclose in-use energy performance in order to demonstrate a trajectory to achieving the target over time.

Question 6	Do you agree that the percentage reduction target should be expressed as equivalent values in DEC ratings, NABERS ratings and kwhe/m2 values for NLA and GIA? Please specify any other benchmarks which you think should also be set out as equivalent target.
Summary	The majority of respondents agree with using kWh/sqm as the primary metric (expressed in both NLA and GIA) as this is the most well-understood metric to enable market acceptance. Clarity was sought on whether this would be broken down for tenant vs. landlord areas and whether there would be conversion factors for fossil fuel use (or if the target assumed a fossil fuel free building). Two respondents offered interesting suggestions to measure the energy intensity not by physical floor area, but by some other productivity metric e.g. kWh/per person or kWh/economic contribution. This could potentially address the unknown variable of growing/shrinking office floor space and create consistency across other sectors. Some respondents, whilst recognising the benefits of normalisation and separating energy loads, did not support prioritising the use of DECs or NABERS.
Proposed updates	• Headline target: kWh/sqm • Secondary targets: equivalent industry ratings How is on-site fossil fuel use addressed - allowable? Industry standard conversion factors?

Question 7	A single target is proposed to cover all commercial office buildings. Do you think different targets should be developed for different office building types, for example: (1) new buildings vs existing buildings (2) air conditioned vs. naturally-ventilated, (3) with vs. without server room, (4) adjusted for occupant density, or (5) normalised for climate.
Summary	The majority of respondents agreed with a single headline target to convey the "simplicity and beauty" of the Paris Proof approach. However, 5 respondents were in favour of a different target date for new vs. existing buildings and 3 respondents were in favour of the target being separated for tenant vs. landlord areas.
Proposed updates	• Headline target of X Landlord target Y; tenant target Z Based on average energy split in office buildings, however with a note that this should be determined for each individual building. • Headline target of X New buildings and major refurbishments by 2030; existing buildings by 2050 All existing buildings should have in-use performance measured and reported by 2030?

Question 8	Do you have any further comments or suggestions on energy performance targets for commercial offices or the Paris Proof methodology?

Summary	Other suggestions included: • separating the target for tenant vs. landlord areas, • the need for interim targets (5-15 years) to focus efforts and the verification of continued action, in a similar vain to SBTs, • the need to consider embodied carbon impacts, especially for upfront carbon (new buildings) and deep retrofits (existing buildings), • updating the target as more accurate information becomes available, and • clarifying how on-site renewables affect the calculations (i.e. that the target is only for electricity drawn from the grid). Generally, the commentary was supportive including suggestions to extend the Paris Proof methodology to other types of buildings.
Proposed updates	All of the above suggestions should be addressed, either explicitly or qualitatively (i.e. place the onus on the stakeholder to think more holistically about applying the target).