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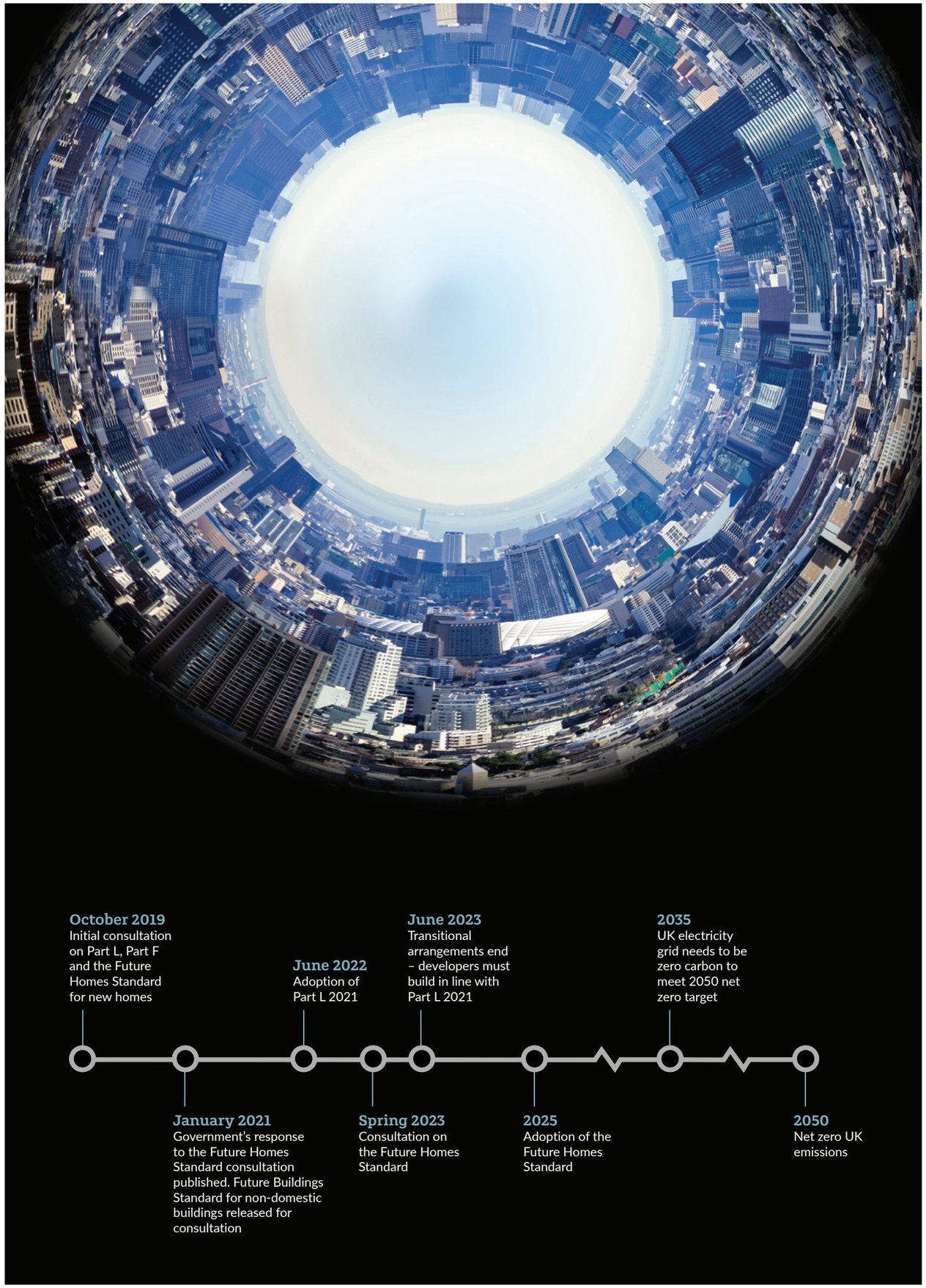
Part L and the Future Homes Standard. Summary of the Government's consultation response.

SUSTAINABILITY GROUP
APRIL 2021



Part L and the Future Homes Standard. Our overview.

On 1 October 2019, the Government released its consultation on an update to Building Regulations entitled 'The Future Homes Standard: changes to Part L and Part F of the Building Regulations for new dwellings', supported by an update to the Standard Assessment Procedure (SAP 10.1) and Approved Document L.

Responses to the consultation were invited, and our firm, along with other consultees from across the built environment and other sectors, gave feedback.

In January 2021, the government released its official response to the consultation along with supporting updates to Approved Document L.

This note summarises the key aspects of the consultation response, along with fabric and servicing approaches that could respond to the Future Homes Standard.

At a glance.

Part L 2021 to be adopted June 2022.

Future Homes Standard to be adopted in 2025.

No gas boiler 'ban' in 2025, but regulations such that fossil fuel heating will not achieve compliance.

Local planning authorities will retain powers to set higher energy efficiency targets than building regulations.

A home built to Part L 2021 standards will emit 31% less CO_2 on average than one built to current standards (Part L 2013).

Primary energy target introduced.

Fabric Energy Efficiency target retained.

Heat network 'technology factors' scrapped – homes connected to heat networks will need to meet the full primary energy, emission, and fabric energy efficiency rate.

All new homes to be air tightness tested.

Transitional arrangement will be valid for 12 months from adoption of Part L 2021, but apply to individual buildings, rather than development sites.

Part L and the Future Homes Standard.
Our overview.
CONTINUED

22%
Proportion of UK's Greenhouse gas emissions created by homes.

43%
Reduction in carbon emissions from residential sector since 1990.

A much needed update.

According to the consultation response, homes accounted for 22% of the UK's greenhouse gas emissions in 2018. Whilst this is significant, the response notes that significant progress has been made in decarbonising this sector, reducing emissions by 43% since 1990.

England's Building Regulations were last updated eight years ago. With the substantive changes to the UK energy landscape, Part L 2013 is misrepresentative and no longer fit-for-purpose.

The Chancellor's 2019 Spring Statement included a commitment that "...by 2025, [the government] will introduce a Future Homes Standard for new build homes to be future-proofed with low carbon heating and world-leading levels of energy efficiency."

The consultation recognises the fact that homes built now will be operational in 2050 and that action must therefore be taken to decarbonise new dwellings today: "This means we will need to improve the fabric standards of our homes and build the supply chains and technology options for low carbon heat that will save carbon through the next decade and put us on a cost-effective pathway to 2050."

We now have a confirmed timeline for the adoption of the Standard, and the consultation response indicates this will indeed be by 2025, with an interim update to Part L to be implemented in June 2022, for full application as 'Part L 2021'.

An update to Part F, which details the ventilation requirements for new homes, will accompany the update to Part L.

Above
Wensley Road, Reading
A new build development of 46 dwellings to lead the way in Reading Borough Council's new housing stock being carbon neutral. The development includes a mixture of low rise apartments and townhouses with road diversions and extensive landscaping. The development incorporates low and zero carbon energy technologies and minimises heating requirements through passive design. The scheme is carbon negative due to high performance building fabric including triple glazing, very thermally efficient walls and stringent air tightness, aligned with PassiveHaus principles, along with individual air source heat pumps and high efficiency PVs for each property.

Below
West Byfleet, Surrey
A major development comprising of 196 retirement units, 11,000 sq. ft. communal front of house and back of house areas, 20,000 sq. ft. of A1-A5 retail space, a replacement public library extending to 3,000 sq. ft. and a public square. The scheme is targeting whole life net zero carbon through a considered approach to materials and systems. The design has been driven by a focus on net zero creating a very low energy sustainable development that embraces the Future Homes Standard and beyond.

Part L and the Future Homes Standard. Summary of the consultation and response.

The Ministry for Housing, Communities, and Local Government (MHCLG) received a total of 3,310 responses to the consultation.

According to the original consultation document, "To meet the Future Homes Standard by 2025, industry will need to develop the necessary supply chains, skills and construction practices to deliver low-carbon heat, and highly energy efficient new homes."

"In addition to a high level of fabric efficiency [the government] also proposes that a low carbon heating system is integral to the specification of the Future Homes Standard. The consultation noted that technologies, such as hydrogen, may have a role to play in heating systems of the future. However, for new homes, we anticipate that heat pumps and heat networks (and to a lesser extent direct electric heating) will be the principal means of producing low-carbon heat for buildings built to the Future Homes Standard."

The consultation suggested that, by implementing low carbon heating systems, a home built to the Future Homes Standard will leverage the continued decarbonisation of the electricity grid to achieve net zero operational emissions without need for further material improvements.

The following pages present a brief summary of the key topics in the consultation response.

Heating technologies.

According to the consultation response: "The Building Regulations will continue to set a performance-based standard rather than mandating or banning the use of any technologies. However, to ensure that new homes are zero carbon ready, we intend to set the performance standard of the Future Homes Standard at a level which means that **new homes will not be built with fossil fuel heating, such as a natural gas boiler.**"

It goes on the state that "Currently, electrification is one of the few proven scalable options for decarbonising heat. As set out in the consultation, **we expect heat pumps will become the primary heating technology for new homes** under the Future Homes Standard and we believe that it is therefore important to build the market for them now."

With respect to heat networks, the consultation response notes that they "…will also have an important role to play and are often an excellent solution for new buildings in towns and cities because of their ability to integrate the lowest-carbon heat sources" and that "heat networks are the only way we can exploit larger scale renewable and recovered heat sources such as energy from waste, waste heat and heat from rivers and mines."

With respect to the potential for utilising hydrogen fuel in new homes, the consultation response confirms that the government "…are not yet including hydrogen in SAP as it is yet to be a heating option offered in homes."

Energy efficiency standards.

The initial proposals included a removal of the ability for Local Planning Authorities to set their own energy efficiency targets beyond the performance required by national Building Regulation. This was generally opposed by the consultees, and the consultation response concludes that "To provide some certainty in the immediate term, the Government will not amend the Planning and Energy Act 2008, which means that **local planning authorities will retain powers to set local energy efficiency standards for new homes.**"

Timeline for adoption.

The consultation response confirms that "…work on a full technical specification for the Future Homes Standard has been accelerated and we will consult on this in spring 2023." and that the intention is "…to introduce the necessary legislation in 2024, ahead of **full implementation of the Future Homes Standard in 2025.**"

Whilst the initial consultation indicated a hope to adopt the interim Part L update in 2020, the consultation response confirms that the timeline is now for a June 2022 adoption.

Uplift in baseline performance.

The government has confirmed that it will implement 'Option 2' from the consultation. This represents a moderate improvement in building fabric with a provision of solar PV which will mean **a typical semi-detached home built to the 2021 version of Part L will emit 31% less CO_2 than one built to current standards (Part L 2013).**

The proposed Part L 2021 notional building parameters and indicative Future Homes Standard parameters are as follows.

Table 1: Proposed parameters for Part L 2021 notional dwelling and indicative Future Homes Standard.

Parameter	Part L 2013	Part L 2021	Indicative FHS
Floor U-value (W/m^2K)	0.13	0.13	0.11
External Wall U-value (W/m^2K)	0.18	0.18	0.15
Roof U-value (W/m^2K)	0.13	0.11	0.11
Window U-value (W/m^2K)	1.4	1.2	0.8
Door U-value (W/m^2K)	1.0 (opaque) 1.2 (semi-glazed)	1.0	1.0
Air permeability ($m^3/h{\cdot}m^2$ at 50 Pa)	5	5	5
Heating appliance	Gas boiler	Gas boiler	Low carbon heating (e.g. heat pump)
Heat emitter type	Regular radiators	Low temperature heating	Low temperature heating
Ventilation system type	Natural (with extract fans)	Natural (with extract fans)	Natural (with extract fans)
PV (panel area as % of ground floor area)	0%	40%	0%
Wastewater Heat Recovery System (WWHRS)	None	Yes (36% eff)	None
Thermal bridging (y value, W/m^2K)	0.05	0.05	0.05

Part L and the Future Homes Standard.
Summary of the consultation and response.
CONTINUED

Performance metrics.

Whilst the initial consultation proposed the abolition of the Fabric Energy Efficiency (FEE) standards as a compliance metric, following the consultation responses the government has confirmed the FEE will be retained. They note this removes the justification for the proposed Householder Affordability Rating, as the FEE standard will drive energy efficiency and subsequently low energy bills.

As such, the following four performance metrics will be used for new homes through Part L 2021:

- Primary energy target
- CO_2 emissions target
- Fabric Energy Efficiency (FEE) target
- Minimum standards for fabric and fixed building services

Primary energy target
The consultation response notes that "The decarbonisation of the UK's electricity grid has been a significant success in recent years but as we continue to make progress, CO_2 emissions will become a less effective measure of the energy performance of buildings."

However, the document goes on to say that "we must retain a focus on CO_2 emissions to ensure that developers make low carbon choices when designing all new homes and to track progress against our net zero target."

CO_2 emissions target
As such, CO_2 emissions remain a key focus of the draft regulations, with the target emission rate retained as a primary compliance metric.

Householder affordability rating
Whilst the government have confirmed they intend to scrap the proposed affordability rating, the response notes that "Under the interim Part L 2021 standard, we anticipate that householders will pay around £168 per year on their regulated fuel costs in a home with a gas boiler and a solar panel or around £369 per year on their energy bills in a home with a heat pump."

Fabric Energy Efficiency target
The consultation notes that "The decision to retain the Fabric Energy Efficiency Standard may make it less appealing for some developers to install heat pumps under Part L 2021 in some circumstances, as there will be lower cost savings possible. However, we anticipate that a home built under the option 2 specification with a heat pump will still have a lower capital cost than one built with a gas boiler."

Proposed updates to the Fabric Energy Efficiency standard are being consulted on as part of the Future Buildings Standard consultation.

Minimum standards for fabric and fixed building services
In addition to strengthening the minimum fabric performance (including U-values and air permeability), proposed changes to the minimum standards for building services performance include an uplift to the operational efficiency of gas boilers and heat pumps for both heating and cooling, as well as the minimum efficacy of lighting.

Low temperature heating systems.

Having flow temperatures of 55°C or lower ensures heat pumps can be installed and operated efficiently, but can also improve the efficiency of condensing gas boilers, whilst also reducing losses and improving system efficiency of district heating.

In the government's response, it confirms that guidance will encourage new heating systems to be designed to operate at a flowrate temperature of 55°C or lower, but not explicitly mandate them.

Technology factors for community heating schemes.

In order to encourage heat networks, the original proposals included a weighting (or 'technology factor'), which would be applied to the target emission rate and primary energy for new dwellings where the design incorporates heat networks.

However, due to firm industry opposition to this proposal, the consultation response confirms that: "To encourage the decarbonisation of existing heat networks and the building of new lower carbon heat networks in future, we will not provide technology factors or any other relaxation in standards for heat networks. Therefore, **new homes connected to heat networks will need to meet the full primary energy, emission and fabric energy efficiency rate.**"

Air tightness.

The consultation response confirms that: "In line with the consultation proposals, [the government] will introduce a credit limit of $3m^3/(h.m^2)$ for both as design and as-built air permeability in SAP for naturally ventilated dwellings."

Currently only a proportion of final dwellings need to be air tightness tested. However, the government has confirmed that: "In line with the consultation proposals, [it] will include requirements that **all new dwellings should be airtightness tested, including small developments.** This requirement will ensure that all dwellings, regardless of the size of development, meet the standard."

Furthermore, "in line with the consultation proposals, [it] will adopt an independent approved airtightness testing methodology, which will be CIBSE TM23."

Transitional arrangements.

The consultation response confirms that the government "...will implement the approach set out in consultation, which means that **transitional arrangements will apply only to individual buildings, rather than site wide as they have in the past.**"

It goes on to confirm that the regulations will set a reasonable period of one year, which will allow developers 12 months from when regulations come into effect to commence work on each individual building on site.

It notes that "For transitional arrangements to apply to an individual building, developers will need to both:

i. Submit a building / initial notice or deposited plans by June 2022; and
ii. Commence work on each individual building by June 2023."

Part L 2021 and the Future Homes Standard. Impact on fabric and servicing approach.

Understanding how the proposals will impact delivering homes in practice is integral to determining their viability.

Using beta Part L 2021 compliance software, a number of potential servicing strategies for a typical 90m^2 terraced house were assessed to determine their dwelling emission rate i.e. the regulated CO_2 emissions per square metre of internal floorspace.

Two fabric scenarios were tested:

a. Part L 2021 notional dwelling – roughly in line with a good typical construction today
b. Indicative Future Homes Standard – an uplift in fabric performance, particularly for glazing

All iterations were naturally ventilated via openable windows.

SCENARIO 1
Gas boiler with Part L 2021 fabric

With a fabric in line with the Part L 2021 notional, the dwelling is able to just achieve compliance with Part L 2013, but fails to achieve the Target Emission Rate (TER) for Part L 2021 by a margin of 63%.

This demonstrates the relative uplift in performance between a Part L 2013-compliant dwelling and one which achieves compliance with the emerging update. This also shows the impact including PV in the notional dwelling will have on the TER under Part L 2021.

SCENARIO 2
Gas boiler with Future Homes Standard fabric and PV

To achieve compliance with Part L 2021, the dwelling tested for Scenario 1 must be supplemented with a PV array of around 19sqm as well as improved fabric in line with the indicative Future Homes Standard.

SCENARIO 3
Direct electric with Part L 2021 fabric

Whilst the greatly reduced carbon factor of electricity allows the dwelling with typical fabric to achieve the Target Emission Rate (TER) with a direct electric heating strategy, it does not achieve compliance with the newly introduced Target Primary Energy Rate (TPER).

SCENARIO 4
Direct electric with Future Homes Standard fabric and PV

Only by improving the fabric to be in line with the Future Homes Standard and providing a PV array of ~30sqm could the direct electric dwelling in Scenario 5 to achieve the TPER.

However, an array of this size is unlikely to be accommodated on the available roofscape, meaning achieving compliance with Part L 2021 using a direct electric strategy is likely to

Station Hill, Reading
Image: Callison RTKL

Part L 2021 and the Future Homes Standard.
Impact on fabric and servicing approach.
CONTINUED

Gwynfaen Farm

be extremely challenging, if not impossible, for most homes without deploying additional technologies such as waste water heat recovery systems (WWHRS) or battery storage. Even with a typical WWHRS, a PV array of over 22sqm is anticipated to be required, which is still likely to be challenging to accommodate.

SCENARIO 5
Direct electric with Future Homes Standard fabric, PV and battery storage

When twinned with PV, battery storage now presents a benefit under Part L and can reduce the primary energy rate of the dwelling. In the case of the direct electric home in Scenario 4, it reduces the PV array required from 30sqm to 19sqm, allowing it to be accommodated on the available roofscape.

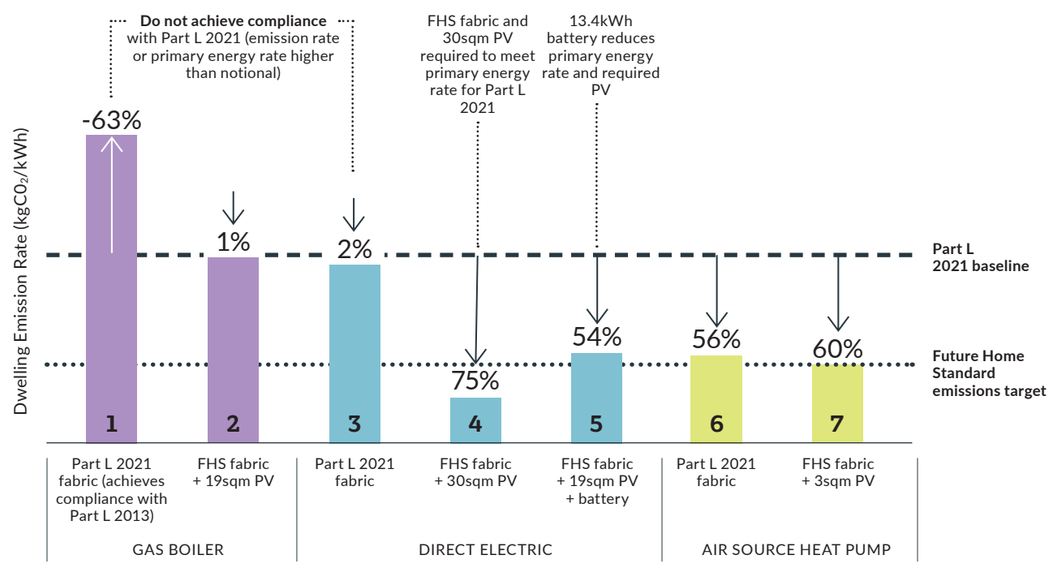
SCENARIO 6
Air source heat pump with Part L 2021 fabric

Supplementing the gas boiler in Scenario 1 with a modest air source heat pump allows the dwelling to comfortably achieve compliance with Part L 2021 without any significant uplift in fabric performance over a typical construction seen today.

SCENARIO 7
Air source heat pump with Future Homes Standard fabric and PV

Improving the fabric of Scenario 3 to be in line with the indicative Future Homes Standard fabric and providing a modest PV array of just 3sqm would allow the dwelling to achieve the

Figure 1: Dwelling emissions rate for a typical 3-bed semi-detached home under a variety of servicing strategies under the emerging SAP/Part L 2021 methodology.



75% reduction in CO_2 emissions (relative to a home compliant with Part L 2013) indicated as being the baseline to be set by the Future Homes Standard in 2025. Note, this does not include any benefit from the likely continued decarbonisation of the electricity grid over the next four years, which would improve the performance against the notional dwelling served by a gas boiler.

It is worth noting that this is the only combination of fabric and servicing that achieved the Future Homes Standard whilst requiring a PV array which could reasonably be accommodated on a dwelling of this scale, indicating that the Future Homes Standard is likely to further drive uptake of electric heat pumps.

The driving force: Net Zero 2050.

The driving force behind the proposals is the UK's legally-binding obligation to reach net zero by 2050. Figure 2 (on the following page) shows the dwelling emission rate for the typical terraced dwelling under a variety of carbon factor scenarios.

The results under Part L 2013 reinforce the current approach to servicing dwellings, with gas-CHP often favoured for providing emissions reductions of 20% to 50%. Direct electric strategies must be supported by high performance fabric and other mitigation measures to achieve compliance.

As presented in the previous section, the situation is drastically different under the new proposals, with electric strategies offering marked improvements over a gas boiler.

Looking to the future, the benefit of electric systems at reducing regulated emissions becomes ever more apparent. National Grid ESO concluded in their 2020 Future Energy Scenarios (FES)

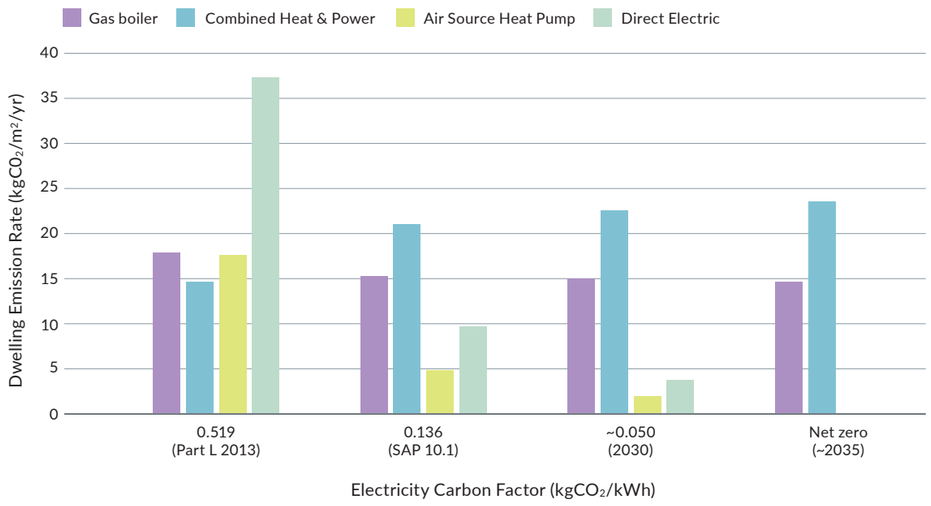
Part L 2021 and the Future Homes Standard.
Impact on fabric and servicing approach.
CONTINUED

report that, in order for the UK to meet its 2050 net zero target, the energy supply sector (i.e. the carbon intensity of electricity) must achieve net zero emissions by the early- to mid-2030s.

As such, using the approximate projected carbon factor for electricity in 2030 for the scenarios which meet the 2050 target, the heat pump strategy is anticipated to demonstrate ~90% fewer emissions than a gas boiler strategy, with no other fabric or services improvements, and will operate at net zero operational carbon by around 2035.

This highlights the challenge of decarbonising fossil fuel-heated buildings: where all-electric strategies continue to leverage improvements in national- and regional-scale infrastructure, gas strategies must employ rigorous local mitigation (in the form of fabric improvements and renewable generation) to offset their remaining emissions. Even this becomes ever more challenging using electricity-generating technologies such as solar PV, as the emissions which can be displaced by these technologies reduces as the grid decarbonises.

Figure 2: Dwelling emission rate for a typical semi-detached home for a variety of servicing strategies using carbon factors from current building regulations (Part L 2013) and proposed building regulations (Part L 2021), as well as the projected carbon factor for 2030. The grid is anticipated to be operating at zero carbon from ~2035.
Source: National Grid ESO Future Energy Scenarios 2020.



Our experience: going beyond Building Regulations.
Creating healthy, sustainable homes ready for the future.

Building Regulations are driving more energy efficient, lower carbon homes. But this pursuit of net zero carbon must not come at the expense of homes that work for the people that live in them. Likewise, viability is also an important factor, as the UK needs houses, and the cost of constructing these must still deliver value for both communities and developers.

The following two recent case studies show how we have collaborated with other industry leaders to explore going beyond compliance to deliver future-friendly homes.

RIBA Home of 2030 competition winners.

In collaboration with Homes England, RIBA recently concluded its Home of 2030 competition, which sought to develop a housing design which was ready for the future, with a focus on being age-friendly and low carbon.

We were invited to join one of the six finalists – Openstudio – to develop its Connector Housing concept, providing MEP, sustainability, acoustics, air quality, daylight, and lighting design support.

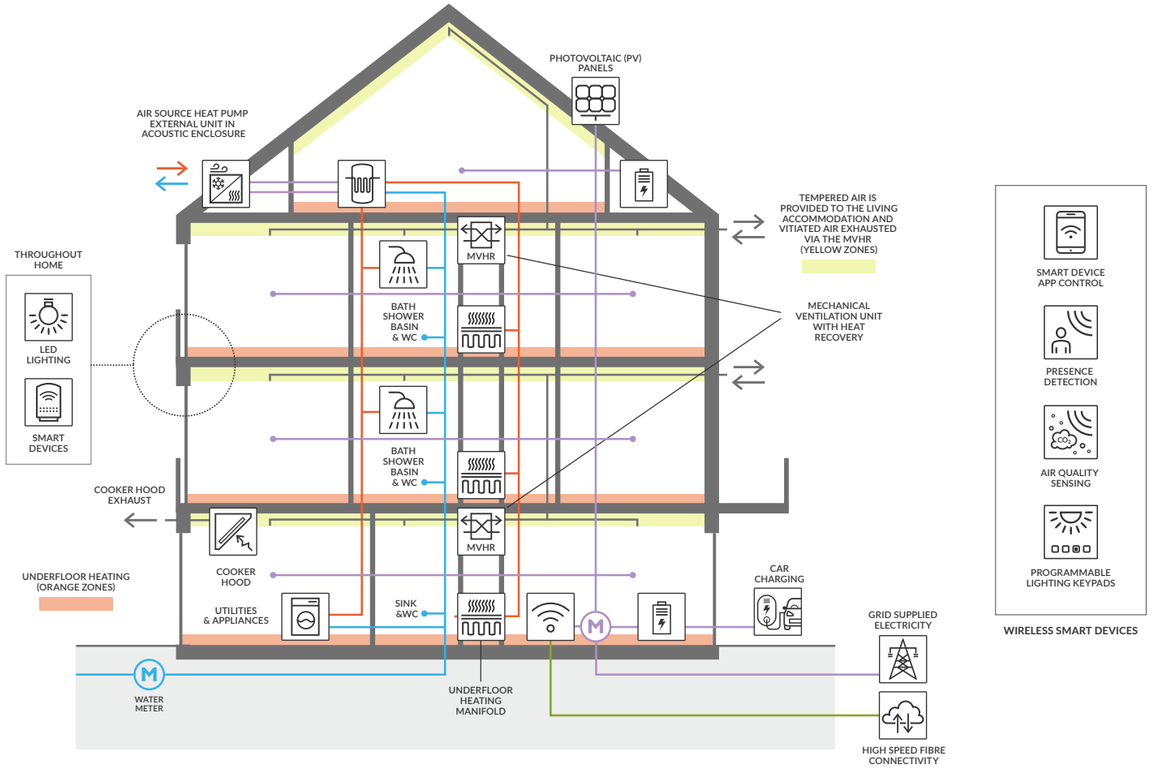
Image: Openstudio

Opportunities for rolling out the design are being explored with a number of parties.

Our experience.
RIBA Home of 2030.
CONTINUED

Our MEP design
We took an integrated approach to building services design, with a focus on deploying smart and intelligent systems to provide the highest performance and most comfortable internal environment, facilitating high levels of health and wellbeing as well as a low carbon operation.

Figure 3: MEP overview.



Operational energy
We conducted a series of assessments on a sample 1-storey plus loft typology. Looking at operational energy performance, we anticipate that the Connector Housing would demonstrate an energy consumption per square metre less than half that of the average 2017 new build prior to the deployment of renewables such as PV.

An irradiance assessment was conducted to calculate potential PV output and based on this, we anticipated that around 17sqm of PV could entirely offset the annual energy consumption of the sample dwelling.

This means that the Connector Housing could achieve net zero carbon operation status, in line with the UKGBC Framework Definition, without the need for carbon offsets.

Looking to the future, PV performance of silicon alternatives such as thin-film is likely to approach or even exceed the performance of silicon panels, and we expect that, with this technology, the sample home could generate 30% or more excess energy per year, making it net carbon negative in operation.

Figure 4: Operational energy consumption of the sample dwelling, with and without PV.

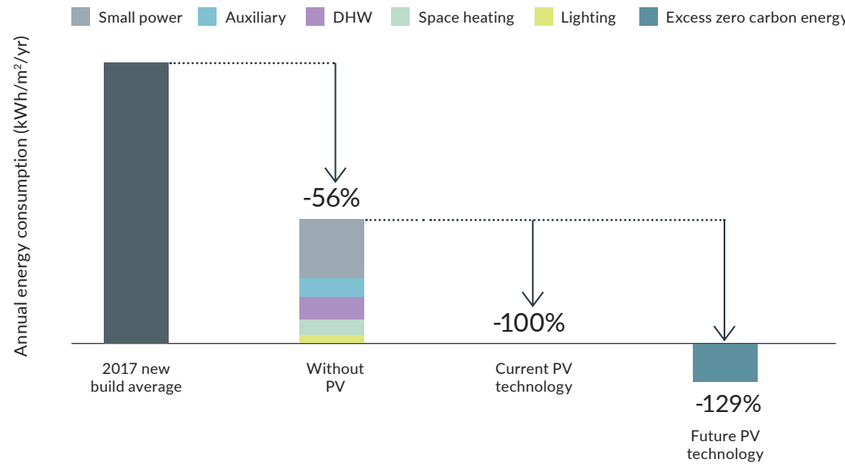
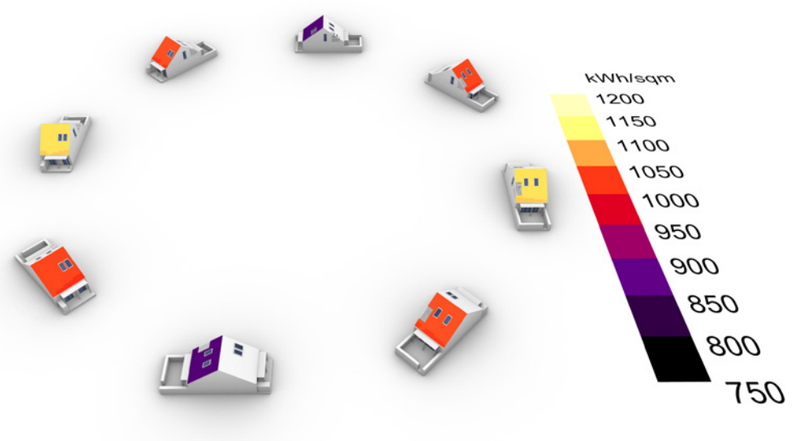


Figure 5: Irradiance on the roof of the sample dwelling at 8 key orientations, used to calculated average PV output.



Our experience.
RIBA Home of 2030.
CONTINUED

Figure 6: Flexible artificial lighting solution.

Embodied carbon
Looking at embodied carbon compared to recent industry targets, when including sequestration from the timber frame, Connector Housing is anticipated to meet the RIBA 2030 Climate Challenge target with a margin of 14% and achieve the LETI target by more than 30%.

Daylight and lighting
Daylight modelling showed that all rooms demonstrate good levels of natural lighting and this was very important given the flexible nature of the design, allowing spaces to be bedrooms, living spaces, or anything in between as the application necessitates. Whilst daylight was a key consideration, so too was celebrating darkness and providing innovative, flexible artificial lighting solutions which can move around the home and beyond, delivers personalised, adaptable lighting to suit each person's needs and tastes.

Thermal comfort
Being thermally comfortable is a critical component of health & wellbeing; summer overheating is at best an annoyance and at worst a risk to life. In a warming climate, the risk of overheating is increasing, and with a drive for more airtight and thermally efficient homes, the problem can be further exacerbated.

We conducted an overheating risk assessment using 2020, 2050, and 2080 weather files and demonstrated that Connector Housing is able to meet the CIBSE risk criteria in all cases.

Air quality and acoustics
In addition to thermal comfort, internal air quality and exposure to noise are key considerations for overall health & wellbeing. Air quality, particularly, is emerging as a dominant risk to health in the UK.

Recognising this, building systems and fabric were designed to avoid noise nuisance and sensors were included to monitor concentrations of pollutants, with filtration provided to ensure high levels of internal air quality.

If considered as an integral part of the design, energy performance and health & wellbeing can both be optimised without the need for compromise, ensuring homes can work for both people and planet.

Our experience.

CONTINUED

UKGBC Building the Case for Net Zero – Apartments.

Building Regulations and compliance is one thing, but achieving net zero today – in line with the UKGBC definition – is a different challenge.

The UKGBC wanted to understand what design interventions would be needed to achieve net zero for a new build apartment and the consequent cost uplift to do so.

Along industry colleagues, we used the case study of an 18-storey Build-to-Rent apartment building in Brighton to explore how we might get there.

Targets
We tested three scenarios – a baseline, intermediate, and stretch case – which are described shortly, but in order to benchmark the results, we set targets for operational energy and embodied carbon based on industry guidance from RIBA and LETI.

In both cases the Stretch targets are in line with what the industry has declared is necessary for new buildings to achieve if they are to be in line with our national 2050 Net Zero ambitions.

The baseline targets reflect a business-as-usual approach and the reduction from these to the stretch targets gives an indication of the progress that must be made.

Table 2: Targets set for the project.

Scenario	Operational energy kWh/m² (GIA)/yr	Embodied carbon Module A kgCO_2e/m²
Baseline	**146** RIBA – business as usual	**800** LETI – business as usual
Intermediate	**70** RIBA – 2025 target	**500** LETI – 2020 target
Stretch	**35** RIBA – 2030 target	**300** LETI – 2030 target

Scenarios
This following table summarises the architectural and servicing strategies tested for each of the scenarios categorised by their main area of influence – embodied or operational.

BASELINE
The Baseline reflected the 'as designed' scheme which was submitted for planning. This included a traditional concrete sub- and super-structure, with a typical fabric performance and a gas boiler to provide space heating and domestic hot water.

INTERMEDIATE
The Intermediate scenario strengthened the approach. From a structural perspective, this included using post-tensioned slabs to reduce slab depth and conducting pile tests to reduce the number of piles required. Looking at fabric and servicing, the U-values and air permeability were improved and the gas boiler was substituted for an air source heat pump to provide heating and hot water.

STRETCH
The stretch scenario pushed the approach to its limits. This included substituting the concrete frame for partial timber structure comprising glulam and CLT. The glazing ratio was reduced from around 50% to 30% and the fabric was pushed to be around Passivhaus standards. A Chlorine Dioxide dosing system was included to negate the need to temperature-based control of legionella and subsequently improve the generation efficiency of hot water.

Table 3: Scenarios tested.

	BASELINE	INTERMEDIATE	STRETCH
Embodied	– Reinforced concrete sub and superstructure – Full brick façade with SFS frame system. – Piled foundations – Interior fit out included	– Reinforced concrete sub and superstructure with post tensioned slabs – Masonry wall construction. – Piled foundations with pile tests	– Partial timber structure, concrete core and basement
Operational	– Building fabric as per planning application (U-value 0.18 to walls, 1.6 for windows) – Air permeability 5m³/m²/h – Double glazing, ~50% glazing ratio – Gas boiler and radiators – Mechanical ventilation with heat recovery – Occupier choice of white goods	– Improved U-values (U-value 0.15 to walls, 1.1 for windows) – Improved air permeability (2 m³/m²/h) – Triple glazing – Air source heat pumps, radiators and electric immersion – Low flow water fittings	– Further improved U-values (0.13 to walls, 0.8 for windows) – Further improved air permeability (1 m³/m²/h) – ~30% glazing ratio – Air source heat pumps, ClO_2 dosing and radiators – LED lighting improvements – Best practice choice of white goods

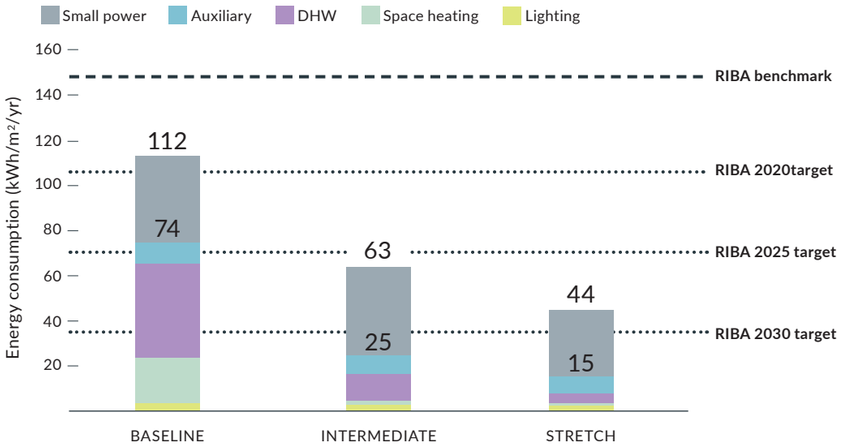
Operational energy
For operational energy, we managed to meet the targets for the Baseline and Intermediate scenarios, but – in spite of the significant interventions – the 35kWh/sqm Stretch target remained elusive.

However, we were able to reduce the regulated energy demand – that's basically everything except for tenant plug in loads and appliances – to just 15kWh/sqm, which is an 80% reduction compared to the baseline.

With tenant small power loads representing the lion's share of energy demand in both the intermediate and stretch scenarios, the challenge of meeting the targets for residential buildings becomes clear.

Our experience.
UKGBC Building the Case for Net Zero.
CONTINUED

Figure 7: Operational energy consumption per square metre by end use for the three scenarios.



Embodied carbon
From an embodied carbon perspective, the Stretch target proved too challenging. Without including the carbon sequestered in the timber frame, the stretch scenario achieved embodied carbon of 485kgCO_2/sqm.

Even when including the significant carbon which is actually captured in the timber frame itself, the target proved insurmountable, but was very close to being met, with a total of 315kgCO_2/sqm vs the 300kgCO_2/sqm target.

Cost
The cost consultants, Cast, costed the various changes and concluded that the Stretch scenario would demonstrate a build cost uplift of 5.3% per square metre of lettable floorspace vs the Baseline. However, the Stretch scenario did require the loss of the top two floors to accommodate the increased slab height of the timber structure, which may have an impact on viability.

When including the cost to offset the remaining operational and embodied emissions to achieve net zero status in line with the UKGBC definition, the total cost uplift per square metre increased to 6%.

In spite of the drastic architectural and servicing interventions made, the Stretch targets remained out of reach. This suggests that, for certain typologies (particularly taller buildings) the suitability of a single climate-proof target for all residential buildings could be challenged.

Elephant and Castle, London
Image: Hayes Davidson

HOARE LEA

Engineers of human experiences.

Hoare Lea is an award-winning engineering consultancy with a creative team of engineers, designers, and technical specialists. We provide innovative solutions to complex engineering and design challenges for buildings.

Irrespective of the scale or complexity of a project, we provide a full range of MEP, environmental, and sustainability services, bringing buildings to life and ensuring that they perform in operation as well as they look.

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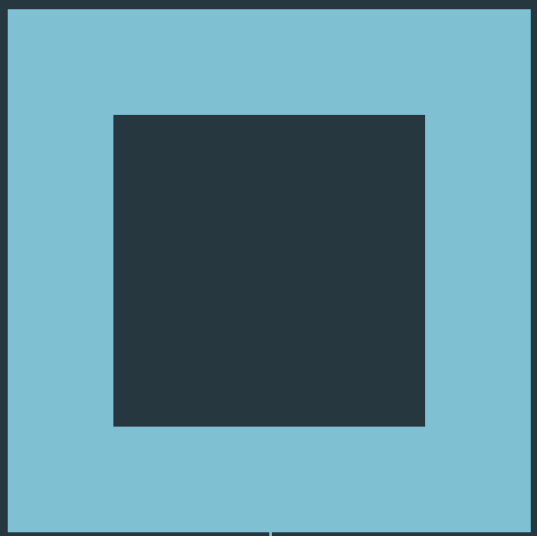

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