Scottish Building Regulations:
Proposed Changes to Energy Standards, including ventilation, overheating and electric vehicle charging provision

Consultation Response:

The Passivhaus Trust

in collaboration with

Collective Energy

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Consultation on proposed changes to energy standards within Scottish building regulations, including related topics such as ventilation, overheating and electric vehicle charging provision

Overview (from consultation page):

> *Scottish building regulations set minimum standards applicable to new buildings and to new work to existing buildings.*
>
> *Our recent draft Heat in Buildings Strategy sets out our vision for decarbonising heat and reducing energy demand across all buildings in Scotland, setting out the scale of the investment opportunity and supporting our green recovery from the Covid-19 pandemic.*
>
> *Following review in 2007, 2010 and most recently in 2015, these new proposals for the review of energy standards set through building regulations seek to deliver further improvement to the energy efficiency of new buildings and new building work, in line with our wider net zero ambitions.*
>
> *Proposals (for mid-2022) will also address consequential changes to ventilation provision arising from improved energy standards, set out plans for assessment and mitigation of overheating risk in new dwellings and residential buildings, improve compliance with energy standards and seek views on separate proposals (for later implementation) for electric vehicle charging provision in new buildings and those subject to major renovation.*

Seven draft guidance documents are issued in support of this consultation. These can be downloaded via links below.

Response due by 26 November 2021

Links:

Proposed Changes to Energy Standards and associated topics

Respondent Information Form and Consultation Questionnaire

Consultation Proposals – Section 6 (Energy) Domestic

Consultation Proposals – Section 6 (Energy) Non-Domestic

Consultation Proposals – Domestic Building Services Compliance Guide

Consultation Proposals – Non-Domestic Building Services Compliance Guide

Consultation Proposals – Standard 3.14 (Ventilation) Domestic

Consultation Proposals – Addressing Overheating Risk in New Dwellings

Consultation Proposals – NCM Modelling Guide for Scotland

Part 2 – Energy, new buildings

Question 1 –

Do you support the extension of standard 6.1 to introduce an energy target in addition to the current emissions target? If yes, do you have a view on the metric applied – primary or delivered energy?

Yes, a primary energy target ☐

Yes, a delivered energy target ☐

No ☐

Please provide a summary of the reason for your view below.

The Passivhaus Trust support the prioritisation of energy metrics over emissions metrics. Energy demand and use will be a more reliable gauge of the energy efficiency of a property as the switch to electricity for heating is rolled out and the grid decarbonises.

We support the use of a primary energy target as well as delivered energy target however we would emphasise the importance in clarifying how these parameters are defined and implemented. We agree that Primary Energy targets will need to apply the relevant weighting factors as set out in current Section 6 consultation proposals for the energy source of the building.

In order to establish a robust target for Primary Energy and Delivered Energy targets, the targets should be based on the energy demand of the building prior to the deductions attributable to the input of any energy generated by on-site/ direct link renewables. This is to encourage a fabric first approach to energy reduction in lieu of a reliance on renewable technology to reduce energy demand. The reduction in energy demand attributable to renewable sources could then be defined as a separate figure with an optimum threshold for renewable energy delivery set. Not all sites are suitable/ economically viable for integration of on-site renewable energy generation and may be reliant on off-site contributions (private wire or other), or connection to heat networks.

Additionally, the building's energy demand would be better defined through incorporating both regulated and unregulated energy use. Unregulated energy use can be accounted for either through a notional weighting applied to the regulated use or through calculation based on the building services design and anticipated occupancy/ use. This latter approach is utilised in the Passivhaus calculation software, the Passivhaus Planning Package (PHPP) and serves to more accurately represent the overall energy demand or delivered energy that the building owner/ tenant can expect.

With regard to Delivered Energy Targets the recent work undertaken by LETI to set Energy Use Intensity targets for new properties is a useful guide and benchmark. The Energy Use Intensity figure is an expression of the total energy use at meter per square meter per

annum (kWh/m2/yr) and includes for regulated and unregulated energy use prior to inclusion of contributions from renewable energy generated on site.

The PHPP has the capability of calculating Primary Energy Demand, Delivered Energy and carbon emissions alongside supporting ventilation calculations and summer overheating analysis. It is our view that the PHPP should be included as a compliance assessment tool (akin to SAP) within the building standards for 2022.

Question 2 –

What level of uplift to the 2015 standard for new dwellings do you consider should be introduced as an outcome of this review?

Option 1: 'Improved' standard (32% emissions reduction) ☐

Option 2: 'Advanced' standard (57% emissions reduction) ☐

Another level of uplift ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust recognises the improvements offered under the 'Advanced' standard but do not feel these go far enough in order to meet Scotland's commitments to being Net Zero by 2045.

We advocate the application of the Passivhaus Standard as a means to make significant reductions in the carbon emissions of new and existing buildings. Further information can be found here Passivhaus: The Route to Zero Carbon?

The level of cost uplift identified for the 'Advanced' standard in the consultation documents is around the measured cost uplift to deliver Passivhaus certified homes, these effectively eliminate the performance gap, something that the current proposals will not. See Passivhaus Trust Cost Report. It is also important to note that many social housing providers in Scotland are working to Passivhaus certification within existing funding parameters with hundreds already in progress in Glasgow. We believe the 'Advanced' level should algin with the Passivhaus Standard. And the Passivhaus Planning Package (PHPP) design and compliance tool should be included as an alternative route to show compliance with the new kWh/m^2 energy/ space heat demand metric(s).

It is essential that the delivery of emissions reductions is prioritised through fabric first measures and complemented by renewable energy generation wherever possible. As the shift is made to decarbonising our heating supply through the use of electricity our buildings will place increasing demands on the electricity grid. Without considerable fabric improvements to our new and existing building stock, we are likely to result in energy demands for heating and hot water that far exceed projected grid capacity. We really need our buildings to use a lot less energy in the first place, especially our new ones!

The Passivhaus Trust are acutely aware that the current consultation only addresses carbon emissions relating to energy use or operational carbon. We actively encourage the Scottish Government to initiate regulation of the embodied carbon associated with construction of buildings, further guidance for which can be found here:

The RIBA 2030 challenge

LETI Climate Emergency Design Guide

Question 3 –

What level of uplift to the 2015 standard for new non-domestic buildings do you consider should be introduced as an outcome of this review?

Option 1: 'Medium' standard (16% emissions reduction) ☐

Option 2: 'High' standard (25% emissions reduction) ☐

Another level of uplift ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust recognises the improvements offered under the 'High' Standard but do not feel these go far enough in order to meet Scotland's commitments to being Net Zero by 2045. We believe that a level equivalent to the domestic level of reduction of 57% should be implemented here as a baseline from 2022 with further improvements made in 2024.

We advocate the application of the Passivhaus Standard as a means to make significant reductions in the carbon emissions of new and existing buildings. Further information can be found here Passivhaus: The Route to Zero Carbon?

The level of cost uplift identified for the 'Advanced' standard in the consultation documents is more than the industry is reporting for Certified Passivhaus non-domestic buildings, with many projects being delivered at no extra cost, by using the Passivhaus design tool, PHPP, to drive efficiencies in the early design decisions, which off-set the extra cost of the higher performing fabric. In addition, Passivhaus Certification effectively eliminates the performance gap, something that the current proposals will not. It is important to note that the Scottish Futures Trust (SFT) Net Zero Carbon for Public Buildings (NZCPBS) standard sets energy targets kWh/m^2 and sets embodied carbon calculation methods and target rates. We believe that the 'High' standard should encompass this standard and Passivhaus which are all being delivered by design teams, within funding parameters across Scotland.

It is essential that the delivery of emissions reductions is prioritised through fabric first measures and complemented by renewable energy generation wherever possible. As the shift is made to decarbonising our heating supply through the use of electricity our buildings will place increasing demands on the electricity grid. Without considerable fabric improvements to our new and existing building stock, we are likely to result in energy demands for heating and hot water that far exceed projected grid capacity. We really need our buildings to use a lot less energy in the first place, especially our new ones!

The Passivhaus Trust are acutely aware that the current consultation only addresses carbon emissions relating to energy use or operational carbon. We actively encourage the Scottish Government to initiate regulation of the embodied carbon associated with construction of buildings, further guidance for which can be found here:

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Question 4 –

Do you have any comments or concerns on the values identified for the elements which make up the Domestic notional building specification for either option, e.g. in terms of their viability/level of challenge?

Yes ☐

No ☐

If yes, please provide your comments.

The Passivhaus Trust are generally supportive of the enhanced performance values set by the Advanced Standard for the notional building specification, recognising these as similar performance values to Passivhaus buildings. However, there are a number of elements which we would seek to change or better.

Space Heating Demand

This is a fundamental metric which needs to be included as a target in the energy assessment methodology. This is currently only featured in Section 7 however it is our view that it would be better to include these targets as part of the Energy Demand criteria for compliance in section 6.

The Passivhaus Standard sets this target at 15kWh/m2/yr, half of what the current Gold Standard requires. The Passivhaus Standard also provides an alternative metric, a maximum peak heat load of 10W/m2.

Thermal Values

Under the Advanced standard the performance value for Doors would benefit from being enhanced to meet that the standard set for windows – 0.8W/m2K. Triple glazing for doors and windows will need to become the norm to meet the Advanced standard.

Air Tightness

It is strongly recommend that this be enhanced from what the Advanced Standard recommends 3m3/(h.m2)@50Pa to 1m3/(h.m2)@50Pa or less. This apparently incremental gain can have a significant impact on reducing energy use. It is essential that more onerous standards are adopted now to encourage upskilling of the industry in delivery of more robust detailing of construction projects.

Ventilation

The Advanced Standard identifies the use of Mechanical Ventilation with Heat Recovery which we are in agreement with. This needs to become the baseline ventilation strategy, particularly if enhanced air tightness (3m3/(h.m2)@50Pa or better) is to be targeted.

There is potentially some flexibility with the level of efficiency of MVHR units. 86% is a good target but clarity needs to be given that this should apply to the installation of the system as a whole. The Passivhaus Standard recommends a minimum 75% efficiency which

accommodates for any losses in efficiency through the installation. For SAP the efficiency test is based on the supply air stream, i.e. reporting the benefit of using the heat recovery unit. For Passivhaus it is based on the exhaust airstream, i.e. how much heat is still being lost to atmosphere. This is an important differentiation as in reality there are gains through the casing body, and air leakage into the unit. As the surrounding air is likely to be warmer (20C air in a home, average temp in MVHR is halfway between inside and outside so if outside = 0C then MVHR temp is 10C) so leakage and case losses heat up the average temperature; if you measuring the supply temp then these are seen as a benefit to the efficiency – it looks like you've recovered more heat – but if you are measuring the extract temp it is seen as a greater loss. For this reason manufacturers of Passivhaus compliant units tend to have very airtight cases that are well insulated. A great efficiency in SAP does not mean it is better than even a poor efficiency in a Passivhaus test. It is possible to compare the specific fan power of the two systems, Wh/m3 (W per m3/h) into W/l/s (W per l/s); the Passivhaus figure account for both fans whereas as we understand it the SAP figure only accounts for one, so a SFP in a Passivhaus test of 0.45 Wh/m3 (only just compliant) = 1.62 W/l/s for both fans or 0.81W/l/s for a single fan. This is measured at a test pressure of 100Pa. The SAP test doesn't disclose what pressure it is tested against. More information on the test procedure here:
https://passiv.de/downloads/03_Reqs_and_testing_procedures_ventilation_en.pdf

Further guidance on location of the MVHR unit will need to be set out in the building standards to ensure optimum efficiencies are delivered, including insulation of pipework and location relative to external walls.

Thermal Bridging

The assigned Y-Value allowance of 0.04 is an acceptable baseline target which the proposed building should always aim to improve on. Thermal bridge modelling will become an essential part of this process to demonstrate compliance.

Backstop Values

These should be brought up to the level of the notional building specification to ensure poorer energy performance does not become more readily justifiable. Lower thermal performance values and continued use of double glazing will result in buildings continuing to suffer from winter discomfort and issues such as condensation.

Method of Calculation

The consultation recommends retaining the elemental (notional building) methodology. This is an issue if we want our regulations to incentivise low energy design through early design decisions around form and orientation, with an aim to reduce total energy demand. The review proposes an alternate approach via calculation of the total space heating demand for the dwelling, instead of elemental (notional building) approach. We strongly advise that this becomes the default (rather than alternative) method of compliance for domestic and non-domestic buildings.

The Passivhaus Planning Package (PHPP) must be included in the building standards as an acceptable calculation methodology. This is the only tool we have that has been shown to consistently match design and in-use performance. This approach is already included in the PAS 2035 methodology (for retrofits).

Passivhaus Performance Criteria for New Build

Further to this we recommend that the Passivhaus standards are included in the building standards as an exemplar set of criteria for meeting the Section 6 requirements.

These are as follows:

Space Heating Demand – 15 kWh/m2/yr or less

Heating load - 10W/m2 or less (alternative compliance target to space heating demand)

Airtightness – 0.6 ach@50Pa or less

Renewable Primary Energy Demand – 60kWh/m2/yr or less

Additionally, the criteria set by the Passivhaus plus standard could be included for on-site renewable energy generation.

Renewable Energy Generation (relative to building footprint) – 60kWh/m2/yr or greater

Existing Buildings

The standards applied to existing buildings need to be made more onerous too. Conversion of our existing building stock will become an increasing imperative in order to meet future sustainability and carbon reduction goals. It is recognised that retrofit is more costly than new build which is a matter that needs to be addressed at a governmental level through incentive schemes and VAT exemptions.

Within the legislative framework of the building regulations the standards that are applied to new builds will be harder to achieve however should generally be targeted.

The Passivhaus EnerPHit standards should be used as an exemplar for meeting Primary Energy Demand, Space Heating Demand, Air Tightness, Thermal Bridging and fabric performance standards.

The LETI retrofit guide is a further useful benchmarking tool for the above parameters and it offers energy use intensity (Energy Demand) targets as well as water heating targets and water usage targets.

We do recognise that not all buildings, particularly listed buildings could meet these standards and alternative compliance may be needed in these cases.

Question 5 –

Do you have any comments or concerns on the values identified for the elements which make up the Non-domestic notional building specification for either option, e.g. in terms of their viability/level of challenge?

Yes ☐

No ☐

If yes, please provide your comments.

The Passivhaus Trust recognise the improvements offered by the 'High' Standard but do not believe that these go far enough. There are a number of elements which we would seek to change or better. It is important to note the Scottish Futures Trust Net Zero Carbon for Public Buildings standard which sets energy targets kWh/m2 and sets embodied carbon calculation methods and target rates. The 'High' standard should encompass this standard and Passivhaus which are all being delivered by design teams, within funding parameters across Scotland. Please refer also to the LETI Climate Emergency Design Guide.

Space Heating Demand

This is a fundamental metric which needs to be included as a target in the energy assessment methodology. This is currently only featured in Section 7 however it is our view that it would be better to include these targets as part of the Energy Demand criteria for compliance in section 6.

The Passivhaus Standard sets this target at 15kWh/m2/yr (with an alternative peak heat load target of 10W/m^2).

Thermal Values

All minimum thermal values should be uplifted to at the very least meet the 'Advanced' Standard for domestic properties with the relevant amendments noted for the performance value for Windows and Doors (both set to 0.8W/m2K). Triple glazing for doors and windows will need to become the norm to limit heat loss and reduce energy demand.

Air Tightness

It is strongly recommend that this be enhanced from what the 'High' Standard recommends 3m3/(h.m2)@50Pa to 1m3/(h.m2)@50Pa or less. This apparently incremental gain can have a significant impact on reducing energy use. It is essential that more onerous standards are adopted now to encourage upskilling of the industry in delivery of more robust detailing of construction projects.

Ventilation

Mechanical Ventilation with Heat Recovery will be essential to meet the more onerous energy demand requirements. This will need to become the baseline ventilation strategy, particularly if enhanced air tightness (3m3/(h.m2)@50Pa or better) is to be targeted.

Further guidance on location of the MVHR unit will need to be set out in the building standards to ensure optimum efficiencies are delivered, including insulation of pipework and location relative to external walls. We recommend the Passivhaus test procedure is followed for MVHR efficiency reporting. More information on the test procedure here: https://passiv.de/downloads/03_Reqs_and_testing_procedures_ventilation_en.pdf

Thermal Bridging

The assigned Psi allowances are concerning as they may represent considerable sources of heat loss once the rest of the building has been thermally enhanced. Careful consideration will need to be given to these connections and thermal bridges to ensure that cold spots and condensation risks do not emerge. Thermal bridge modelling will become an essential part of this process to demonstrate compliance and thermal robustness of junctions.

Backstop Values

These should be brought up to the level of the notional building specification to ensure poorer energy performance does not become more readily justifiable. Lower thermal performance values and continued use of double glazing will result in buildings continuing to suffer from winter discomfort and issues such as condensation.

Passivhaus Performance Criteria for New Build

Further to this we recommend that the Passivhaus standards are included in the building standards as an exemplar set of criteria for meeting the Section 6 requirements.

These are as follows:

Space Heating Demand – 15 kWh/m2/yr or less

Heating load - 10W/m2 or less (alternative compliance target to space heating demand)

Airtightness – 0.6 ach@50Pa or less

Renewable Primary Energy Demand – 60kWh/m2/yr or less

Additionally, the criteria set by the Passivhaus plus standard could be included for on-site renewable energy generation.

Renewable Energy Generation (relative to building footprint) – 60kWh/m2/yr or greater

Existing Buildings

The standards applied to existing buildings need to be made more onerous. Conversion of our existing building stock will become an increasing imperative in order to meet future sustainability and carbon reduction goals. It is recognised that retrofit is more costly than

new build which is a matter that needs to be addressed at a governmental level through incentive schemes and VAT exemptions.

Within the legislative framework of the building regulations the standards that are applied to new builds will be harder to achieve however should generally be targeted.

The Passivhaus EnerPHit standards should be used as an exemplar for meeting Primary Energy Demand, Space Heating Demand, Air Tightness, Thermal Bridging and fabric performance standards.

The LETI retrofit guide is a further useful benchmarking tool for the above parameters and it offers energy use intensity (Energy Demand) targets as well as water heating targets and water usage targets.

As noted in our response to Question 2, the Passivhaus Trust are acutely aware that the current consultation only addresses carbon emissions relating to energy use or operational carbon. We actively encourage the Scottish Government to initiate regulation of the embodied carbon associated with construction of buildings, further guidance for which can be found here:

The RIBA 2030 challenge

LETI Climate Emergency Design Guide

Question 6 –

Do you have any comments on the simplified two-specification approach to defining the Domestic notional building from 2022?

Yes ☐

No ☐

If yes, please provide your comments.

The consultation recommends retaining the elemental (notional building) methodology. This is an issue if we want our regulations to incentivise low energy design through early design decisions around form and orientation, with an aim to reduce total energy demand. This notional method uses a set of pre-defined performance characteristics which are applied to the shape/size and layout of a new building to determine a target emissions level. These performance characteristics have been chosen to reduce emissions levels by a certain percentage from a 1990 baseline and thus have been gradually tightened over the years. The SAP modelling method is used for both the notional and proposed building. The problem with this method is that the actual amount of emissions could still be relatively large – particularly if the design of the building is poor. For example, a sprawling, complex shape with lots of glazing will have a relatively high rate of emissions even with reasonably good fabric u-values. This means that you are starting your reductions from, in effect, an arbitrary starting point.

This building standards review proposes an alternate approach via calculation of the total space heating demand for the building, instead of an elemental (notional building) approach. We strongly advise that this becomes the default method, rather than the alternative, to compliance for domestic and non-domestic buildings.

Additionally, the Passivhaus Planning Package (PHPP) should be considered for inclusion in the building standards as an acceptable calculation methodology. This is the only tool we have that has been shown to consistently match design and in-use performance. This approach is already included in the PAS 2035 methodology for retrofit.

Question 7 –

Do you have any comments on the simplified two-specification approach to defining the Non-domestic notional building from 2022?

Yes ☐

No ☐

If yes, please provide your comments.

The consultation recommends retaining the elemental (notional building) methodology. This is an issue if we want our regulations to incentivise low energy design through early design decisions around form and orientation, with an aim to reduce total energy demand. This building standards review proposes an alternate approach via calculation of the total space heating demand for the building, instead of an elemental (notional building) approach. We strongly advise that this becomes the default method, rather than the alternative, to compliance for domestic and non-domestic buildings.

Additionally, the Passivhaus Planning Package (PHPP) should be considered for inclusion in the building standards as an acceptable calculation methodology. This is the only tool we have that has been shown to consistently match design and in-use performance.

Question 8 –

Do you have any comments on the proposal to separate and provide a more demand-based approach to assignment of domestic hot water heating within the Non-domestic notional building specification from 2022?

Yes ☐

No ☐

If yes, please provide your comments.

This approach makes sense and better caters for building specific water heating demands.

We would also like to highlight that whilst water use will vary considerably with user behaviour, for a low-energy building system losses for DHW can be higher than for space heating and contribute to summer overheating. See this paper - International Passivhaus Conference Dresden

Question 9 –

Do you support this change in application of targets for supplied heat connections to new buildings, focussed on delivering a consistent high level of energy performance at a building level?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

No strong view on this matter

The Passivhaus Trust recognise the need for the expansion of heat networks and see that these will serve urban areas which have limited potential for on-site heat or power generation, particularly existing buildings that may be more challenging to retrofit. However, this is not always a suitable solution, as we have seen instances where it has been problematic for new buildings to connect to heat networks as the losses have been greater than the consumption.

In order for the heat network to be truly classed as a zero-emissions heat source it will need to be generated using 100% renewable energy sources or have a certified carbon sequestration/ capture & storage system in place to offset any associated emissions. Heat Distribution Networks will require considerable investment in infrastructure to become effectively established and viable and this will take time. Distribution losses through the network are a considerable issue with heat networks and undermine their efficiency.

We recognise that the proposed changes seek to limit the impact of the constraints of heat networks on future buildings and provide an equitable approach. We accept that this may be the most workable interim solution but would caveat that this should be reviewed at subsequent building standards revisions.

One of the risks that we see with connection to heat networks is that this becomes the primary energy efficiency measure. Whilst this may need to be the case for heavily constrained existing properties we see that new buildings or major renovations should seek to implement fabric first measures as the primary energy efficiency measure. This makes the utilisation of heat pumps more viable as a means of supplying heat due to the greatly reduced energy demand.

Question 10 –

Do you agree with the principle set out, that the benefit from on-site generation within the compliance calculation should be limited by a practical assessment of the extent that generated energy can be used onsite?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Are there any particular concerns you have over this approach, e.g. with regards particular technologies or solutions?

We agree with the principles set out in this approach, recognising the importance of identifying the usefulness of renewable energy generated on site and how this contributes to a reduction in energy demand for the specific property.

As outlined above, we advocate the importance of being able to separate out the level of renewable energy contributing to the building's lower energy demand. To this end we support the separation of Primary Energy Demand, Delivered Energy Demand and Renewable Supply to provide clarity on level of compliance and what the end user can expect to consume.

Question 11 –

Do you agree with the proposal that new buildings where heat demand is met only by 'zero direct emissions' sources should be exempt from the need for a calculation to demonstrate compliance with the Target Emissions Rate?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We strongly disagree with this proposal on the following grounds:

1 – The definitions leave the door open to using energy systems that can still be emitters, such as hydrogen. The only hydrogen heat source that can be classed as zero emissions is green hydrogen which has limited supply currently and requires significant industry upscaling and infrastructure improvements to be classed as a viable zero emissions heat source.

2 – Another zero direct emissions heat source is the use of electric systems like storage heaters. In order for this to be truly zero emissions it would need to be powered from on-site renewably generated electricity alone. The grid is projected to decarbonise over the coming decades but there is no guarantee that it will entirely decarbonise meaning that now and in the future we cannot rely on grid electricity supplied to the property to be classed as zero carbon.

Our view is that projected emissions should always be calculated with further details on how those emissions have been mitigated or eliminated provided through calculation, assessment and specification. This can be through the SAP methodology or PHPP or other approaches.

The Building Regulation view of Net Zero thus far has assumed that all the generated energy can be used to directly offset demand. However, the majority of solar energy is generated in the summer, but the peak demand from the house is in the winter. In fact, all of our primary sources of renewable energy, wind, tidal and solar, fluctuate daily and with the seasons. So a factor for storage losses much be included. See our paper on this - Passivhaus the route to zero carbon

Question 12 –

Do you support the need for new buildings to be designed to enable simple future adaptation to use of a zero direct emissions heat source where one is not initially installed on construction. And for information setting out the work necessary for such change to be provided to the building owner?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Do you have any comments on the level of information needed to support such action in practice or on the extent to which alterations other than those at, or very close to, the heat generator can be justified?

Properties that cannot be delivered to meet the requirements for zero emissions need to be able to demonstrate how they can be cost effectively retrofitted to do so in future.

For this route to compliance to work, fabric first energy efficiency measures need to be implemented through the initial phase as a priority with the services related measures required for transitioning to zero direct emissions following on after.

This requires the initial design to accommodate for any future adaptation. This can be demonstrated through the allowance on plan for future equipment and the provision of a Net Zero transition roadmap including guidance on suitable adaptation measures that will complement the as-built building, taking into consideration factors such as occupancy, building use, fabric performance, ventilation strategies and air tightness.

The measures to achieve zero carbon as a retrofit should primarily be easy and cost effective to install without detriment to the existing building.

Question 13 –

Do you support the retention of the current elemental approach to setting minimum standards for fabric performance in new dwellings, supported by the option to take an alternate approach via calculation of the total space heating demand for the dwelling (as described)?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

In the context of the proposed approach, If you have any comments on the maximum U-values proposed for elements of fabric, in relation to their level of challenge and achievability at a national level, please set them out below.

The Passivhaus Trust broadly supports the minimum U-Values values set for the Advanced Standard notional building only, albeit with the modifications noted previously relative to windows, doors and infiltration/ air tightness.

In addition, we recommend that space heating demand as a metric for compliance should be included in the Section 6 performance criteria.

Further to this we recommend that the Passivhaus standards are included in the building standards as an exemplar set of criteria for meeting the Section 6 requirements.

These are as follows:

Space Heating Demand – 15 kWh/m2/yr or less

Heating load - 10W/m2 or less (alternative compliance target to space heating demand)

Airtightness – 0.6 ach@50Pa or less

Renewable Primary Energy Demand – 60kWh/m2/yr or less

Additionally, the criteria set by the Passivhaus plus standard could be included for on-site renewable energy generation.

Renewable Energy Generation (relative to building footprint) – 60kWh/m2/yr or greater

Whilst we support the setting of minimum performance standards as a guide we must point out the necessity that these cannot be treated as the lowest common denominator. Every new-build project should ideally be modelled using advanced and up to date energy modelling software - SAP 10.1 (or 11 when it is released) and/ or the Passivhaus Planning Package. The use of these tools is essential to ensure that there is not a significant performance gap in delivery of the Advanced Standard at design stage and through the build. Moreover, these tools must be able to allow the designer to select the most appropriate energy efficiency measures for the building type, form, orientation and fabric,

allowing for optimisation and efficiency without simply ticking boxes against meeting certain performance values.

For this reason we strongly advise that the Passivhaus Planning Package should be recognised within the building standards as a tool for demonstrating compliance. This can be used alongside or in place of SAP.

As recognised through the review of past building standards and the 'health check' of the Scottish housing stock, the inclusion of area weighted maximum u-values (backstop values) means that these values often end up becoming the de facto target resulting in poorer performance being locked into new buildings. It is important to avoid this and to this end we would recommend exclusion of maximum area weighted u-values, only providing a minimum value in line with those set out in the Advanced Standard (albeit with recommendations set out above). This starts to raise the bar to the necessary performance standards required to meet Net Zero commitments by 2045 or before.

The Passivhaus Trust recognises that this makes the delivery of energy efficiency measures more onerous in cost terms however, the urgency of the response to the climate emergency as well as the trajectory that the industry needs to set itself on to meet Scotland's Commitments to Net Zero by 2045 or sooner sets a pressing need for higher energy efficiency standards to be implemented in 2022. Failure to do so now will simply result in the need to retrofit properties in the near future at far greater expense.

The cost analysis carried out through this building standards review process has demonstrated that the uplift in costs for the Advanced option is in the region of 5-7%. This echo's the current industry's assessment of the uplift for implementation of Passivhaus Standards to a design. With Passivhaus providing the distinct benefit of providing a robust route to eliminate the performance gap, so that the extra cost directly results in better performing buildings. By contrast extensive monitoring of new buildings built to current building regulations has shown that there is an average a performance gap between design calculations and in-use space heating use of at least 60%. We need to address this performance gap as a matter of priority.

Question 14 –

Do you support the move to airtightness testing of all new dwellings, by registered members of an appropriate testing organisation?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust supports the air tightness testing of all new properties to ensure that air tightness is achieved to the correct levels in each new property and that the performance gap is not baked in through under performance in selected untested properties. Air testing has been shown to both improve general build quality and reduce defects, including future fabric damage caused by interstitial condensation.

The Passivhaus Standard advocates whole block air tightness so careful testing methodologies need to be developed at construction stage to facilitate individual property's air testing requirements to demonstrate compliance.

Question 15 –

Do you support the move to increased airtightness testing of all new non-domestic buildings, by registered members of an appropriate testing organisation?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust see this as beneficial to ensuring build quality and that energy performance targets are being met at completion.

Question 16 –

Do you support the adoption of CIBSE TM 23 as the basis for airtightness testing in Scotland?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust understand the benefits of a uniform, cross sector approach to testing. We understand that this testing methodology has been developed without comprehensive consultation of stakeholders and trust that further versions of the guidance will incorporate input from cross industry working groups to ensure quality and relevance.

Question 17 –

Do you support the introduction of the pulse test method of airtightness testing as a further means to resting and reporting on the performance of new buildings?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Are there any particular benefits, risks or limitations you would seek to identify?

The Passivhaus Trust does not support this on the following grounds:

- it would create confusion in the industry giving results at 4Pa rather than 50Pa
- we will end up with two sets of results in the industry and confusion - this is the main disadvantage as we see it, unnecessary confusion
- you can't use the test to carry out diagnostics i.e no smoke testing or thermography, these are very valuable tools when constructing low energy buildings.
- with the blower door test you get a sense of the level of leakage but with the pulse test you do not.

We would like to see some independent testing to prove the accuracy of this type of test, we are not aware of any such tests, if these do exist, we would be happy to review this again, although the fundamental issues around industry confusion and the loss of diagnostic testing remain.

Question 18 –

Do you consider this amended provision provides an appropriate balance between:

- the requirement to improve building energy performance in new buildings;
- enabling the reuse of better performing modular elements; and
- enabling use of small units for short term use at short notice?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The reuse of modular assemblies is an important part of maintaining a circular economy. Wherever possible these should be upgraded to meet current or enhanced thermal performances, however the limitations of these systems must be recognised.

The application of a weighting factor and different backstop u-values (which could be set higher wherever possible) for reuse of modular systems is a sensible approach.

Newer builds should ideally target current enhanced standards of efficiency wherever reasonably possible.

Question 19 –

We welcome any other comments you wish to make on the proposed changes to the setting of performance targets for new buildings or the application of other amended provisions within Section 6 (energy) which apply to the delivery of new buildings.

Where practical, please with a reference to any particular issue in the context of the Domestic or Non-domestic Handbook (or both if applicable) and cite any standard or revised guidance clause relevant to the topic.

The Passivhaus Trust recognise the benefits of the changes being put forward in this consultation and support the more advanced efficiency measures being implemented wherever possible, however we would note that the proposals in this consultation review:

• fall far short of what is required for Scotland to meet its Net Zero commitments in the building sector and risk locking in poorer efficiency standards for years to come.

• will not deliver to the aspiration of the policies proposed by Scotland's Climate Assembly

The Passivhaus Trust would like to direct this consultation's attention to the publication of Scotland's Climate Assembly report which clearly mandates the adoption of Passivhaus & EnerPHit Standards.

"Adopt and implement clear and future-proofed quality standards for assessing the carbon impacts of all buildings public and private using EnerPhit/Passivhaus standards (as a minimum) and integrating whole life carbon costs, environmental impact and operational carbon emissions. "

97% vote in favour

"Update building standards to ensure that, within the next 5 years, all new housing is built to Passivhaus standards (or an agreed Scottish equivalent), to create healthy homes for people while also taking into account whole life carbon costs and environmental impact. "

97% vote in favour

"Within the next five years, update Building Standards Regulations to make it mandatory to apply EnerPHit/Passivhaus standards (or agreed Scottish equivalent), with an assessment of whole life/embodied carbon costs and the environmental impact of the materials used in construction, to all work on new and existing non-residential buildings."

96% vote in favour

The Assembly proposed adoption of Passivhaus for good reason. The Passivhaus standard is often seen as primarily delivering low-energy buildings. It does indeed deliver buildings which demand minimal levels of energy when in use. However, Passivhaus also delivers a lot more.

The particular benefits offered by Passivhaus will be of relevance to different stakeholders. For example, whilst individual homeowners will be interested in comfort and lower energy bills, local authorities may be attracted to improved health outcomes, improved build quality and meeting zero carbon targets, whilst government and energy suppliers may focus on Passivhaus' potential to lower peak demand and reduce our requirement for renewable energy.

In summary Passivhaus Buildings:

- Consistently perform to design targets (building regulation complaint buildings on average result in a 60% performance gap)
- Are the best fit for a decarbonised grid
- Deliver a huge number of health and wellbeing benefits
- Eliminate fuel poverty
- Are the only realistic way to achieve Zero Carbon

We are living in a Climate Emergency, this is no time to reinvert the wheel, we have a proven building standard, with a developed training programme for designers, contractors and consultants, an accurate calculation methodology, a proven route to eliminate the performance gap and deliver high quality buildings. Importantly it is a standard that can be delivered within the cost levels set out in the consultation review.

This review of the building standards presents an opportunity to incorporate the Passivhaus Standard into the current building standards from 2022. The Passivhaus Standard (for New Build) and EnerPHit Standard (for Retrofit) could reasonably be included as exemplar standards utilising the Passivhaus Planning Package (PHPP) as an industry recognised calculation methodology to demonstrate an alternative route to compliance.

This approach is being adopted by other more forward-thinking local authorities in England and Europe in recognition of the Passivhaus Standards proven track record on delivering the energy efficiency standards needed to meet the challenges of the climate emergency.

The Passivhaus Trust are also acutely aware that the current consultation only addresses carbon emissions relating to energy use or operational carbon. We actively encourage the Scottish Government to initiate regulation of the embodied carbon associated with construction of buildings, further guidance for which can be found here:

The RIBA 2030 challenge

LETI Climate Emergency Design Guide

Part 3 – Energy, all buildings

Question 20 –

Do you agree with the proposed introduction of the term 'major renovation' as defined above as an additional means of identifying when aspects of building regulations shall be applied to an existing building?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust support the inclusion of the term Major Renovation and associated definition. This will be a useful trigger for other fabric improvement works. What is important is that the relevant performance standards for the renovation are set at an appropriate standard to meet Net Zero requirements.

Question 21 –

Do you support the improvement in maximum U-values for elements of building fabric for Domestic buildings, as set out above?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We would also welcome your views on the proposed simplification achieved by setting of a single set of values for all building work to new and existing buildings.

The Passivhaus Trust supports improvement to area weighted U-Values for all buildings particularly work on existing buildings. The majority of buildings that exist today will still be in use in 2045. The need to improve the energy efficiency of our new and existing buildings as soon as possible without locking in poor performance is paramount.

In line with our response to Question 13, we recommend that provision of maximum area weighted backstop values is removed for new builds in favour of being able to demonstrate compliance with stated energy performance targets (Primary Energy Demand, Delivered Energy, Space Heating Demand, Water Heating Demand) using energy modelling tools such as SAP 10.1 and/or PHPP to determine the most appropriate energy efficiency measures to be implemented.

As recognised by the consultation, setting backstop values simply lowers the bar resulting in poorer efficiency measures being locked into new buildings for decades to come.

For existing buildings, it is important to set the standard as high as possible and for this reason we recommend that the area weighted values should follow those set out by the Passivhaus EnerPHit Standard for a Cool Temperate Climate as an exemplar standard.

Table 2 EnerPHit criteria for the building component method

Climate zone according to PHPP	Opaque envelope[1] against...				Windows (including exterior doors)					Ventilation	
	...ground	...ambient air			Overall[4]			Glazing[5]	Solar load[6]		
	Insu-lation	Exterior insulation	Interior in-sulation[2]	Exterior paint[3]	Max. heat transfer coefficient ($U_{D/W,installed}$)			Solar heat gain coefficient (g-value)	Max. specific solar load during cooling period	Min. heat reco-very rate[7]	Min. hu-midity re covery rate[8]
	Max. heat transfer coefficient (U-value)			Cool colours							
	[W/(m²K)]			-	[W/(m²K)]			-	[kWh/m²a]	%	
Arctic	Determined in PHPP from project	0.09	0.25	-	0.45	0.50	0.60	U_g - g*0.7 ≤ 0		80%	-
Cold		0.12	0.30	-	0.65	0.70	0.80	U_g - g*1.0 ≤ 0		80%	-
Cool-temperate		0.15	0.35	-	0.85	1.00	1.10	U_g - g*1.6 ≤ 0		75%	-
Warm-		0.30	0.50	-	1.05	1.10	1.20	U_g - g*2.8 ≤ -1		75%	-

Note that some of these values are lower than stated in the consultation's proposed changes to the standards. This reflects the complex nature of retrofits and the need to avoid unintended consequences through over insulation, particularly when being applied internally to solid walls.

The EnerPHit Standard sets out performance values for building components including levels of efficiency for ventilation equipment. Additionally, the EnerPHit Standard sets targets for space heating demand (25kWh/m2/yr), air tightness (1.0 ach@50Pa) and Primary Energy Demand (variable to suit building configuration).

The component method (maximum u-value method) should not be treated as the default backstop. As with new builds, demonstration of compliance through the energy modelling of the building should ideally be undertaken as a first priority wherever practicable. The PHPP is ideally geared for this including tools for step-by-step retrofit energy improvements. The EnerPHit approach and energy modelling using PHPP is an approach that is endorsed by the PAS 2035.

We recognise that retrofit of existing buildings is a complex undertaking and that there are numerous constraints that affect the capacity to meet certain standards. The LETI Retrofit Guide sets out a number of best practice energy, fabric and system targets that could be adopted to better guide the energy efficiency approach for upgrading existing buildings, ensuring that energy efficiency can be optimised without the negative impact of unintended consequences.

Question 22 –

Do you support the improvement in maximum U-values for elements of building fabric for Non[correction to reflect category & content]-Domestic buildings, as set out above?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We would also welcome your views on the proposed simplification achieved by setting of a single set of values for all building work to new and existing buildings.

Please refer to our comments in questions 13 & 21 above regarding setting of maximum u-values.

We recognise that with non-domestic buildings, the energy use of hot water and ventilation becomes more significant and these elements need to be compensated for in the design. This notwithstanding, the first form of energy efficiency should always be the building fabric. A robust thermal performance for a new or existing building will reduce energy demand across the board resulting in reduced reliance on services-based solutions for delivering energy efficiencies and reduced emissions.

We recommend the utilisation of the Passivhaus standard as an exemplar benchmarking tool for new build non-domestic buildings. This standard can be utilised in conjunction with relevant CIBSE standards for the efficiency of building services.

We recommend the utilisation of the EnerPHit standard as an exemplar benchmarking tool for the retrofit of non-domestic properties. This standard can be utilised in conjunction with relevant CIBSE standards for the efficiency of building services.

We reiterate the imperative to utilise energy modelling for both new build and existing buildings as the starting point. A holistic energy model alone can justify the use of lower thresholds for energy performance for certain elements, compensating elsewhere using other efficiencies and demonstrating compliance across the building as whole.

Question 23 –

Do you support the standardisation of values and approach for conversions, extensions and shell buildings, as set out above and in sections 3.2.2 and 3.2.3?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Conversions & Extensions

For existing buildings, it is important to set the standard as high as possible and for this reason we recommend that the area weighted values should follow those set out by the Passivhaus EnerPHit Standard for a Cool Temperate Climate as an exemplar standard.

Table 2 EnerPHit criteria for the building component method

Climate zone according to PHPP	Opaque envelope[1] against...				Windows (including exterior doors)					Ventilation	
	...ground	...ambient air			Overall[4]			Glazing[5]	Solar load[6]		
	Insu-lation	Exterior insulation	Interior in-sulation[2]	Exterior paint[3]	Max. heat transfer coefficient ($U_{D/W,installed}$)			Solar heat gain coefficient (g-value)	Max. specific solar load during cooling period	Min. heat reco-very rate[7]	Min. hu-midity re covery rate[8]
	Max. heat transfer coefficient (U-value)			Cool colours							
	[W/(m²K)]			-	[W/(m²K)]			-	[kWh/m²a]	%	
Arctic	Determined in PHPP from project	0.09	0.25	-	0.45	0.50	0.60	$U_g - g*0.7 \leq 0$		80%	-
Cold		0.12	0.30	-	0.65	0.70	0.80	$U_g - g*1.0 \leq 0$		80%	-
Cool-temperate		0.15	0.35	-	0.85	1.00	1.10	$U_g - g*1.6 \leq 0$		75%	-
Warm-		0.30	0.50	-	1.05	1.10	1.20	$U_g - g*2.8 \leq -1$		75%	-

Note that some of these values are lower than stated in the consultation's proposed changes to the standards. This reflects the complex nature of retrofits and the need to avoid unintended consequences through over insulation, particularly when being applied internally to solid walls.

The EnerPHit Standard sets out performance values for building components including levels of efficiency for ventilation equipment. Additionally, the EnerPHit Standard sets targets for space heating/ cooling demand (25kWh/m2/yr), air tightness (1.0 ach@50Pa) and Primary Energy Demand (variable to suit building configuration).

The component method (maximum u-value method) should not be treated as the default backstop. As with new builds, demonstration of compliance through the energy modelling of the building should ideally be undertaken as a first priority wherever practicable. The PHPP is ideally geared for this including tools for step-by-step retrofit energy improvements. The EnerPHit approach and energy modelling using PHPP is an approach that is endorsed by the PAS 2035.

It is recognised that the scale of the conversion or extension will dictate the capacity to adopt these standards and for that reason a practical approach will need to be adopted. Where the conversion or extension form the substantial part of the whole property it will be reasonable to apply these standards to the wider property wherever practicable. Smaller projects may need to focus on a more elemental approach applied to the affected areas.

We recognise that retrofit of existing buildings is a complex undertaking and that there are numerous constraints that affect the capacity to meet certain standards. The LETI Retrofit Guide sets out a number of best practice energy, fabric and system targets that could be adopted to better guide the energy efficiency approach for upgrading existing buildings, ensuring that energy efficiency can be optimised without the negative impact of unintended consequences.

Shell buildings:

The proposals set out in proposed standard 6.1.8 are broadly acceptable apart from the weakening of fabric efficiency standards relative to 2015 standards in favour of a more services focussed approach to delivering efficiency once the unit is fitted out. This is a missed opportunity and goes against the principle that a fabric first approach is the first energy efficiency measure.

Question 24 –

If you have a view on the preferred format for presentation of information on compliance of building services, what would be your preference?

Retain current separate Compliance Guides	☐
Move Compliance Guides into Section 6 as an Annex	✓
Re-integrate into guidance to the relevant standard	☐
Other (please specify in summary box below)	☐

Please provide a summary of the reason for your view.

Inclusion of these documents within Section 6 will aid reference for all consultant parties during the design process.

Question 25 –

Do you support the continued alignment of minimum provisions for fixed building services at a UK level within the Domestic Building Services Compliance Guide?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Are there any issues you wish to raise in relation to the amended or retained specifications set out within the draft Guide?

The Passivhaus Trust do not have a strong opinion on one option over the other.

The Passivhaus Trust sees the benefit of alignment of standards across the UK.

On the other hand, with the building standards being a devolved power, Scotland has the opportunity to raise the bar and go beyond the standards being set elsewhere in the UK.

Question 26 –

Do you support the continued alignment of minimum provisions for fixed building services at a UK level within the Non-domestic Building Services Compliance Guide?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Are there any issues you wish to raise in relation to the amended specifications set out within the draft Guide?

The Passivhaus Trust do not have a strong opinion on one option over the other.

The Passivhaus Trust sees the benefit in alignment of standards across the UK.

On the other hand, with the building standards being a devolved power, Scotland has the opportunity to raise the bar and go beyond the standards being set elsewhere in the UK.

Question 27 –

Do you agree with the proposal that the option of installing a less efficient heat generator and compensating for this using heating efficiency credits in existing buildings should be withdrawn from the Non-domestic Building Services Compliance Guide?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We agree with the view that energy efficiency of appliances has improved over recent years and that there is no longer a need for this measure.

Question 28 –

Do you agree with the proposal to limit distribution temperatures in wet central heating systems to support effective implementation of low and zero carbon heat solutions and optimise the efficiency of heat generation and use?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We agree with this approach in order to optimise future low and zero carbon heat solutions in new and existing buildings.

Question 29 –

Do you agree with the proposed extension to the provision of self-regulating devices to include when replacing a heat generator?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Do you have any comment on issues of technical feasibility or determining when installation should be at a room/zone level?

The Passivhaus Trust supports the proposed extension to the provision of self-regulating devices when replacing a heat generator.

Implementing this measure at a room/ zone level will be beneficial to owners/ tenants/ occupants to provide greater control over their internal environment and personal/ operational energy efficiency measures.

Question 30 –

Do you agree with the proposed introduction of a requirement for building automation control systems, of the type specified, in larger non-domestic buildings with systems with an effective rated output over 290kW

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust agree with this proposal on the proviso that there is flexibility to which the systems can be implemented, particularly for smaller scale buildings and retrofits. We recognise the importance and benefit of automating building controls. It should also be recognised that these systems consume energy and it is therefore important that they do not become a net contributor to the building's energy demand.

Early calculation of energy demand and configuration of the system is important to ensure energy efficiencies are delivered beyond those that can be offered in the form of automated control. A number of non-domestic Passivhaus buildings have been designed without BMS. BMS should not be assumed to automatically save energy. Efficient buildings only need very simple controls.

Question 31 –

We welcome any other comments you wish to make on the above topics and broader changes to the setting of minimum standards for all buildings.

Where practical, please with a reference to any particular issue in the context of the Domestic or Non-domestic Handbook (or both if applicable) and cite any standard or revised guidance clause relevant to the topic.

The performance gap, endemic to modern buildings, needs to be addressed through this and future revisions to the building regulations. This relates to services as much as building fabric.

Clear guidance on the efficiency of services as well as their installation needs to be set out in the building standards to make legislation of efficiency and quality robust.

Clearer targets for space heating demand and water heating demand need to be integrated into domestic and non-domestic standards. These may sit in Section 7 in the short term but we would recommend from 2024 these become a part of section 6 requirements, given that they relate directly to energy efficiency and emissions targets.

We welcome the focus towards transitioning towards heat pumps and a decarbonisation of heat in buildings. Care needs to be given to considering how this applies to heat networks and the source of heat for these networks. Much is being made of hydrogen as a source of future clean energy however the efficiencies of this energy source and the means for attaining the hydrogen need to be made clear and transparent to consumers and developers. The only true source of renewable hydrogen is green hydrogen, utilising 100% renewable electricity and electrolysis to create hydrogen. Huge investment in infrastructure will be required to make these shifts and we do not have time to wait for the industry to provide the changes we need today. We therefore need to work with the effective tools we have to hand – heat pumps, renewable electricity (solar, wind, hydro, tidal), nuclear, etc.

At a building level, encouraging a maximisation of renewable energy generation, either on site or linking to new or existing renewable infrastructure through private wire or other arrangements, is going to be fundamental to making the shift away from fossil fuels increasingly viable without having an adverse impact on the grid. In addition to renewable generation of heat and power, further guidance and support needs to be directed at on site energy storage – batteries, phase change materials, etc.

All of this needs to be supported through the legislative framework as well as a government led incentivisation scheme for private and public projects.

Part 4 – Ventilation

Question 32 –

Do you support the proposed revisions to the presentation of guidance on ventilation and the incorporation of the 'domestic ventilation guide' into the Technical Handbooks?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust supports the inclusion of a revised 'domestic ventilation guide' into the technical handbooks.

Question 33 –

Do you agree with the revision of guidance to clarify the function of purge ventilation and increase provision to align with that applied elsewhere in the UK?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust broadly agrees with the increased requirement of purge ventilation and alignment with UK wide regulations on this topic.

Question 34 –

Do you support reference to a single option for continuous mechanical extract ventilation which can have centralised or decentralised fans, with the same design parameters being applied to the system in each case?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

If you have any further views on the use of continuous mechanical extract to deliver effective ventilation in both low infiltration (3-5 m^3) or higher infiltration (5 m^3+) buildings, we would also welcome your comments.

The Passivhaus Trust agrees with the findings of MEARU and strongly recommends against the use of decentralised MEV systems for dwellings with air infiltration rates below 5m3/(h.m2)@50Pa. A centralised ventilation system will have a greater efficacy as borne out by the study.

In new build properties, the increased levels of air tightness and a lack of understanding by building occupants about how trickle ventilators and extract fans work in unison is contributing to poor air quality, fabric degradation issues through condensation and moisture buildup and health issues of occupants through a buildup of pollutants in the indoor air. This is evidenced in the HEMAC / SEDA document: Indoor Air Quality in Airtight Homes.

For this reason we advocate a mechanical supply & extract ventilation system with heat recovery is advocated over and above any other solution for properties with air infiltration rates below 5m3/(h.m2)@50Pa.

For clarity, we endorse the use of centralised extract ventilation systems in conjunction with background ventilators in any buildings where it is not possible to achieve air infiltration levels lower than 5m3/(h.m2)@50Pa and it is not possible to utilise an MVHR system.

Question 35 –

Do you support introduction of proposed guidance on default minimum size of background ventilator for continuous mechanical extract systems?

Yes ☐

No ☐

Please provide a summary of the reason for your view and on any specific concerns which may arise from the proposed level of background ventilation or its application in the design of systems.

The Passivhaus Trust recognises that for technical, financial or operational reasons some buildings will need to utilise natural ventilation or a mixed mode of natural ventilation with continuous mechanical extract. In these instances, the use of background ventilators will be critical.

In these instances, the provision of clear guidance on the sizing of ventilators based on CIBSE guidance is supported.

Notwithstanding the above, given our recommendation above in question 4 that new dwellings are designed to achieve very low air infiltration rates – i.e. targeting 1m3/(h.m2)@50Pa or less – and, given the relationship between air infiltration and thermal efficiency we strongly recommend that the regulations for new buildings are brought in line with the Passivhaus Standard to utilise a centralised mechanical ventilation with heat recovery system alongside exemplar airtightness performance values of 0.6 ach@50Pa for new builds or 1.0 ach@50Pa for retrofits.

Question 36 –

Should continuous mechanical extract systems be considered a viable solution in very low infiltration dwellings and, if so, under what circumstances?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We would also like to hear your views on whether heat recovery should be mandated for packaged supply/extract systems

The Passivhaus Trust endorses the reduction in air infiltration rates as a means of reducing energy demand and improving energy efficiency. All buildings (especially those with air infiltration rates below 3m3/(h.m2)@50Pa) will benefit from continuous mechanical ventilation.

In these properties the Passivhaus Trust advocates the use of Mechanical Ventilation with Heat Recovery to ensure that air quality is maintained at sufficiently good levels. Through using a ventilation system with heat recovery the system is able to reclaim heat that would otherwise be lost through a standard extract system, further enhancing the energy efficiency of the property.

We recommend that the building standards mandate heat recovery as part of any supply and extract system being installed in a property.

Additionally, the ventilation rate should be clarified to deliver an air change rate of 30m3/h per person. This links the ventilation rate to occupancy and serves to ensure that air quality is maintained at a high level.

We further recommend that MVHR systems are recommended as a suitable ventilation system for properties with air infiltration rates greater than 3m3/(h.m2)@50Pa. Whilst their efficiency levels will not be as high, these properties will greatly improve the air quality in these buildings, improving quality of life and health of the occupants.

Furthermore, given our recommendation above in question 4 that new dwellings are designed to achieve very low air infiltration rates – i.e. targeting 1m3/(h.m2)@50Pa or less – and, given the relationship between air infiltration and thermal efficiency we strongly recommend that the regulations for new buildings are brought in line with the Passivhaus Standard to utilise a centralised mechanical ventilation with heat recovery system alongside exemplar airtightness performance values of 0.6 ach@50Pa for new builds or 1.0 ach@50Pa for retrofits.

Question 37 –

Do you support the incorporating of this additional guidance into the Technical Handbooks?

Yes ☐

No ☐

We would be grateful for comment on the content of the proposed Annex and whether there are elements absent from guidance or which would be better presented within guidance to standard 3.14 itself.

We support the inclusion of the ventilation design guide as an annex in the building standards with relevant excerpts included in standard 3.14.

For SAP the efficiency test of a ventilation unit is based on the supply air stream, i.e. reporting the benefit of using the heat recovery unit. For Passivhaus it is based on the exhaust airstream, i.e. how much heat is still being lost to atmosphere. This is important differentiation as in reality there are gains through the casing body, and air leakage into the unit. As the surrounding air is likely to be warmer (20C air in a home, average temp in MVHR is halfway between inside and outside so if outside = 0C then MVHR temp is 10C) so leakage and case losses heat up the average temperature; if you measuring the supply temp then these are seen as a benefit to the efficiency – it looks like you've recovered more heat – but if you are measuring the extract temp it is seen as a greater loss. For this reason manufacturers of Passivhaus compliant units tend to have very airtight cases that are well insulated. A great efficiency in SAP does not mean it is better than even a poor efficiency in a Passivhaus test. It is possible to compare the specific fan power of the two systems, Wh/m3 (W per m3/h) into W/l/s (W per l/s); the Passivhaus figure account for both fans whereas as we understand it the SAP figure only accounts for one, so a SFP in a Passivhaus test of 0.45 Wh/m3 (only just compliant) = 1.62 W/l/s for both fans or 0.81W/l/s for a single fan. This is measured at a test pressure of 100Pa. The SAP test doesn't disclose what pressure it is tested against. More information on the test procedure here: https://passiv.de/downloads/03_Reqs_and_testing_procedures_ventilation_en.pdf. This difference should be acknowledged in the SAP/ PHPP calculations, the default position in Passivhaus is to subtract 12 percentage points from the stated efficiency of a non-Passivhaus certified unit, so a unit stating an efficiency of 90% would be entered at 78% unless Passivhaus certified.

Question 38 –

Are there other elements of the commissioning of ventilation systems that you consider are both practical to implement and useful in providing additional assurance of performance in practice?

Yes ☐

No ☐

If yes, please provide a summary of the topics which should also be considered.

Consideration should be given to independent testing of installed ventilation systems in line with the air testing or acoustic testing regimes currently in place.

This would potentially facilitate a double test protocol – one whereby the installer test and commissions the system and one where a verifier or assessor test the system.

Further testing through post occupancy evaluation, feedback from occupants and monitoring of air quality with outputs and results shared on public platforms will be beneficial and should be mandated as part of a wider learning and development programme within the industry.

Alongside suitable commissioning, clear and easily understandable information needs to be made available to the end user. This should be in the form of easily to read operational material and should ideally be accessible digitally as well as within a user manual made available at handover.

Question 39 –

We welcome your thoughts on these or broader topics which would merit consideration as part of the planned review. Please set out your thoughts below, including citation of relevant supporting evidence, where relevant.

Broader issues around ventilation, air tightness, indoor air quality and, most significantly perhaps, wellbeing of occupants, can be found here:

Indoor Air Quality in Airtight Homes: A Designers Guide , by HEMAC & SEDA

The Case for MVHR , by The Passivhaus Trust

Question 40 –

We welcome any other comments you wish to make on proposed changes to ventilation standards for domestic buildings.

Where practical, please with a reference to any particular issue in the context of the Domestic or Non-domestic Handbook (or both if applicable) and cite any standard or revised guidance clause relevant to the topic.

The Passivhaus Trust recommends that as the building regulations performance standards shift ever closer towards Passivhaus standards the necessity to harmonise energy and ventilation standards becomes paramount. A halfway approach will result in unwanted heat loss and a widening performance gap. It is therefore important that the building standards grasp the opportunity to integrate the Passivhaus Standard in its entirety as an exemplar methodology for achieving building regulations compliance.

As noted previously, the PHPP can be utilised to demonstrate compliance with energy demand, thermal performance and ventilation requirements and consideration should be given to incorporate this toolkit within the building standards alongside SAP and other industry assessment tools.

Part 5 – Overheating risk in new dwellings and other new residential buildings

Question 41 –

Do you agree with the proposed introduction of a requirement to assess and mitigate summertime overheating risk in new homes and new non-domestic buildings offering similar accommodation?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

If you consider that proposals should be extended to non-domestic buildings which provide other forms of residential accommodation (which are not 'self-contained residential units'), we welcome your views on such provisions, including if the same or an alternate approach to assessment is recommended?

The Passivhaus Trust supports the inclusion of the requirement to assess and mitigate summertime overheating risk in new buildings – domestic, other residential & non-domestic. This is viewed as essential to occupant comfort, particularly in buildings that are designed to be increasingly airtight and thermally efficient.

Limitations on the extent of overheating during the course of a year should be set. The PHPP has a built-in methodology for assessing overheating risk based on the calculation of shading for as designed windows. Adoption of the PHPP as a compliance tool will streamline the approval process for this section of the building standards. In addition to the built-in assessment of overheating, the Passivhaus Trust has developed a new PHPP plugin to stress test summer overheating in UK buildings, including future climate modelling. The Passivhaus Trust recommends this is carried out for all certified buildings. See the Passivhaus Trust guidance on Avoiding Summer Overheating.

Question 42 –

Do you agree with the proposal that an initial assessment of dwelling characteristics should be undertaken to help inform design choices and the delivery of new homes which provide better thermal comfort in the summer months?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

We would also seek the views of respondents on other sources of good practice guidance which have been implemented by developers and the outcome (no reports of significant summertime overheating) evidenced through feedback from residents.

The Passivhaus Trust endorse carrying out summer overheating design risk analysis early in the design process to identify trigger elements and ensure the design responds to the identified risks. This is standard practice through the Passivhaus design process, utilising the PHPP methodology as a tool for building specific modelling, true to the form and orientation of the building.

Additionally, regional climate and weather data is integrated into the PHPP model to allow for more accurate risk modelling and design assessments.

This demonstrates further benefits to incorporating the PHPP as an assessment tool into the building standards as a means for demonstrating compliance.

For further analysis by Scottish Government on summer overheating assessment and good practice we recommend the following publications:

The Passive House in summer - Summer climate in the Passive House – an important issue , by
The Passivhaus Institute

Avoiding Summer Overheating – Guidelines for summer comfort in Passivhaus buildings , by The Passivhaus Trust

Question 43 –

Are there circumstances where you consider specific characteristics of a dwelling should trigger a need for TM59 assessment rather than application of a simple elemental approach?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Some triggers may be as follows:

- Complex geometries for built form or shading elements.
- Larger window proportions with south, east or west orientations,
- Limited opportunities for external shading due to heritage constraints
- Large rooflights with limited or no shading
- A need to determine the extent (acceptable or otherwise) of overheating – i.e. 10% overheating may be acceptable but this would only be determined through modelling.

Question 44 –

Recognising the level of risk identified in the published research paper, do you agree with the above proposals as a suitable means of mitigating summertime overheating in new homes through prescriptive actions?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

The Passivhaus Trust would like to question the assessment methodology of the simple element approach. Whilst more accessible to designers at an early stage this approach does leave things open to interpretation at which point the risk of compromised performance is apparent.

Using purge ventilation and having the MVHR in summer bypass mode are sensible mitigation measures, however the optimum approach is to ensure that glazing orientation, proportion, and shading is properly developed through the design process.

Question 45 –

Do you consider that such an approach will provide adequate assurance that ventilation measures provided to mitigate summer overheating can be used safely and conveniently in practice?

Yes ☐

No ☐

Please provide a summary of the reason for your view.

Dynamic Thermal Modelling will be a useful tool to establish what the overheating risks are and when coupled with ventilation modelling could be used to establish the opportunities for cooling through ventilation. These more active measures need to be weighed against the need for reduced energy demand.

Through a comprehensive implementation of the Passivhaus approach including the utilisation of MVHR in conjunction with other ancillary systems, the building can be cooled in summer through the use of summer bypass of the ventilation system, supplemented by using openable windows or utilising other ancillary systems to enhance cooling, providing greater flexibility to occupants, especially in locations where the opportunities to open large areas of glazing may be limited for reasons of security, noise, pollution or comfort. All models depend on assumptions resulting in a key weakness when determining summer comfort.

Question 46 –

We welcome any other comments you wish to make on these proposals to introduce provisions to mitigate the risk of summer overheating new homes and new residential buildings.

The PHPP methodology allows designers to interrogate the risk of overheating for a building based on its form, orientation, window proportions and shading provision. This is a mathematical assessment based on the building specific data entered into the model.

This is yet another reason for the PHPP methodology to be incorporated into the building standards as a means for demonstrating compliance. As noted in question 41 above, in addition to the built-in assessment of overheating in PHPP, the Passivhaus Trust has developed a new PHPP plugin to stress test summer overheating in UK buildings, including future climate modelling. The Passivhaus Trust recommends this is carried out for all certified buildings. See the Passivhaus Trust guidance on Avoiding Summer Overheating.

Part 6 – Improving and Demonstrating Compliance

Question 47 –

Do you have any experience of successful design or construction quality assurance regimes which you consider may be useful to consider in the context of this 'Compliance Plan manual' work for section 6 (energy)?

Yes ☐

No ☐

If yes, please share any relevant information.

The Passivhaus approach has an established track record of delivering design performance at completion, closing the performance gap and ensuring quality of construction in line with the specification.

Key measures to ensuring the performance gap is closed and design performance compliance is delivered at completion are baked into the Passivhaus approach:

- Rigor of the Passivhaus design process,
- Prioritising fabric first measures,
- Eliminating thermal bridges,
- Enhancing ventilation,
- Enhancing air tightness,
- Understanding construction detailing,
- Implementation of the PHPP as a building specific modelling tool, allowing input on location, regional climate data, orientation, elevation, built form and more.
- Certification of the design by an accredited assessor, including:
    - Design stage checks on the PHPP model
    - Verification of specification data and utilisation of a verified, accredited component scheme to ensure quality and longevity of components
    - Construction stage checks on progress of construction
    - Air tightness testing at multiple stages through construction.
- Verification of construction through site inspection.
- High levels of expertise through the engagement of competent consultants and contractors
- Commissioning & testing of installed equipment to ensure optimum performance
- Post occupancy evaluation and reporting.

Question 48 –

Do you have any comments on the above themes and any other actions you consider would be useful in supporting improved compliance with requirements for energy and emission performance.

Yes ☐

No ☐

If yes, please provide a summary of your views.

The Passivhaus Trust recognise the benefits of establishing clear quality control and assessment protocols in place to ensure build quality and delivery of designed performance targets. The actions/ themes highlighted in this process are all broadly aligned with the Passivhaus approach.

The implementation of a compliance plan is aligned with the verification and certification process implemented through the Passivhaus methodology.

The employ of a 'coordinating individual' is aligned with the role played by the Passivhaus Designer/ Consultant with support from the Passivhaus Certifier. These roles are already established within the construction industry.

Question 49 –

Are there particular aspects of [correction of typo] building design and construction which you consider should be prioritised as part of the development of a detailed compliance manual for section 6 (energy)?

Yes ☐

No ☐

No view ☐

If yes, please provide further details, including any evidence you are aware of that supports such emphasis.

The Passivhaus Trust supports the Quality Assurance Measures outlined in section 6.1.6.

When coupled with the adoption of advanced standards for thermal performance, ventilation, air infiltration, thermal bridging and responsive design for summer overheating these measures will go a long way to closing the performance gap.

To supplement the notes on air testing, we would recommend that a minimum of 2 no. air tightness tests are carried out on new and existing buildings (scale and extent of work to existing building to dictate extent of air testing required). These would be carried out prior to closing up and at completion. Additional air tests can be conducted based on the contractor and clients requirements for demonstrating quality. The spread of air tests through a development may vary from project to project and will depend on the air tightness design for the building.

Post Occupancy Evaluation (POE) will become an increasingly important tool for demonstrating as-built compliance. The completion of the building contract is in effect the start of a building's life and from the point of handover and occupation there is a bedding in period that stress tests the building's designed performance that can run from months to years as systems are put to use and the occupancy profile of the building becomes embedded.

The provision of as built SAP calcs at completion is all very good but the real insight will come from implementing soft landings during the closing stages of a project and carrying out post occupancy evaluation exercises in the months and years following completion. These measures will be essential for determining as-built compliance in use. Reporting of findings, including ongoing disclosure of energy use and emissions on a public portal will be a vital for knowledge sharing within the industry and improvement of building standards, to say noting of transparency in meeting Net Zero commitments.

The following elements should be measured as a minimum:

- Indoor CO2 levels – as a proxy for air quality
- Internal temperature

- Internal relative humidity
- Energy use
- Water use

For POE to be successfully implemented, metering requirements, data gathering and anonymised storage protocols need to be come enshrined in the building standards to ensure the relevant information can be assimilated and shared with the wider industry. These protocols are already in use within the industry. It would be good to see these protocols integrated into the building standards for 2022, to encourage their adoption by clients for the benefit of themselves, their tenants, the construction industry and the environment.

Question 50 –

We welcome any other comments you wish to make on these topic of improving compliance of building work with the provisions within section 6 (energy) to better align designed and as-built performance.

The Passivhaus Trust recognises the importance of ensuring design performance is met at through the build. The measures outlined in this section of the consultation documents are broadly aligned with the processes implemented through the Passivhaus design and certification processes up to completion of a Passivhaus project.

The development of a compliance plan recognised across the industry and which is mandated through the building regulations will be a useful tool for managing quality through the design and construction stages.

Definition of suitable levels of competency and identification of new roles within the industry for verification of design will be beneficial too.

Much of the work to reduce the performance gap can be achieved by adopting the Passivhaus Standard as a baseline for performance for new build projects and the EnerPHit standard as a baseline for performance for whole house/ building retrofit projects.

Part 7 – Electric Vehicle Charging Infrastructure

Question 51 –

What are your views on our policy goal to enable the installation of Electric Vehicle (EV) charge points and ducting infrastructure (to facilitate the future installation of EV charge points) for parking spaces in new residential and non-residential buildings parking?

The Passivhaus Trust welcomes the plan to mandate EV charging infrastructure through the building standards.

A blend of charge points and ducting infrastructure is a good starting point as the EV market starts to bed in.

The integration of supply for EVs for private use into the overall energy mix for private dwellings will present an interesting challenge particularly where primary energy demand targets are being set for individual dwellings. The question of where the electricity for these EVs comes from and the associated emissions / grid carbon index of that supply is important to consider.

Wherever possible it would be beneficial for EV parking bays to be supplied by 100% renewable energy. On site generation may be more viable for individual homes than communal parking lots.

The question of car use in urban environments and encouraging modal shifts to public transport and active travel needs to also be weighed up in line with the National Planning Policy Framework. Electric vehicles will always be favourable to fossil fuel powered alternatives but their prioritisation should not be at the cost of more sustainable modes of transport.

Question 52 –

What are your views on our preferred options for EV provision in new and existing buildings?:

The Passivhaus Trust do not have a strong view on this

Question 53 –

Do you agree with the Scottish Governments preferred options for the exemptions as set out in section 7.6.1?

Yes ☐

No ☐

If you disagree, please explain why?

The Passivhaus Trust do not have a strong view on this

Question 54 –

What are your views on how our preferred option relating to existing non-residential buildings with car parks with more than 20 spaces could be properly monitored and enforced, given that the Building (Scotland) Regulations will not apply?

The Passivhaus Trust do not have a strong view on this

Question 55 –

What are your views on the proposed provision for charge points for accessible parking spaces? Do you have examples of current best practice for the provision of charge points for accessible parking spaces?

The Passivhaus Trust do not have a strong view on this

Question 56 –

Do you have any other views that you wish to provide on the EV section of the consultation (e.g. the minimum standard of EV charge point or safety within the built environment)?

The Passivhaus Trust do not have a strong view on this