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Evidence and submission papers

Consultation on Reforms to the Energy Performance of Buildings Regime

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This response, submitted on 26 February 2025, was completed by Cait Hewitt, Policy and Engagement Officer at the Grantham Institute, Imperial College London in response to the Consultation on Reforms to the Energy Performance of Buildings Regime by the Ministry of Housing, Communities & Local Government and the Department for Energy Security & Net Zero.

Please note, the below document is an edited and redacted version of Imperial's submission to the consultation.

Responses to individual questions are by three Imperial academics who have published extensively on building performance and clean heat:

- Dr Salvador Acha Izquierdo – Senior Research Fellow in the Department of Chemical Engineering, Imperial College London (https://profiles.imperial.ac.uk/salvador.acha)

- Dr Richard Carmichael CPsychol, FRSA – Research Fellow in the Centre for Environmental Policy, Imperial College London (https://profiles.imperial.ac.uk/r.carmichael)

- Dr Kate Simpson – Visiting Researcher in the School of Public Heath, Imperial College London (https://profiles.imperial.ac.uk/kate.simpson)

What EPCs measure

To what extent do you agree or disagree that information using an energy cost metric should be displayed on EPCs? Please select one option for each building type.

Agreement that using an energy cost metric should be displayed on EPCs. - Domestic buildings

Agreement that using an energy cost metric should be displayed on EPCs. - Non-domestic buildings

Contributors had different views on this question.

Salvador Acha:
Agree. An energy cost metric is important but needs to be adjusted to take into account the impact of different tariffs on running costs. This should be explained when presenting the metric for clarity and transparency.

Kate Simpson:
Disagree. Energy cost metrics on EPCs are currently misleading as the EPC is not accurate enough and people's heating behaviour is so variable. The cost metrics at present is too specific, with too many uncertainties in the model for it to be useful.

Richard Carmichael:
Strongly agree. Energy costs should be one of the metrics and should be labelled 'costs', not 'efficiency' (as is currently the case) to avoid confusion. But the metric needs to enable like-for-like comparisons. This means it is necessary to control for differences between households in: occupant behaviour; weather (during assessment periods); tariffs; and volatility in energy costs over time. The metric should not be based on actual metered consumption or bills (which could reflect underheating) but should reflect the energy required to adequately heat and run the building to maintain adequate internal temperature (as per some fuel poverty metrics). Costs will be largely for heat (space and water), which represent most of the energy demand.

To what extent do you agree or disagree that information derived from a fabric performance metric should be displayed on EPCs? Please select one option for each building type.

Agreement that information derived from a fabric performance metric displayed on EPCs - Domestic buildings:
Strongly agree

Agreement that information derived from a fabric performance metric displayed on EPCs - Non-domestic buildings:
Strongly agree

All three academics strongly agreed.

Kate Simpson:
A fabric performance metric such as a monitored Heat Transfer Coefficient should result in a much more accurate representation of fabric efficiency than current assumptions. This value can also be an input into the SAP tool, enabling more accurate EPCs.

Richard Carmichael:
'Fabric performance' should be the headline metric (if one is needed). As suggested by the CCC, this metric should be measurement-based, rather than estimated or modelled, and defined as demand intensity (kWh/m2/yr).

When evaluating the fabric performance of buildings, which methodology do you think should inform the basis of calculating a fabric metric? Please select one option for each building type.

Fabric performance of buildings methodology - Domestic buildings: HLP/HTC

Fabric performance of buildings methodology - Non-domestic buildings: HLP/HT

Kate Simpson:
A Heat Transfer Coefficient appears to offer the most useful assessment of fabric performance at present.

Richard Carmichael:

HTC is the best option because it is a measurement of heat loss, not an estimate using models and best guesses about construction type and build quality (SAP and RdSAP have been shown to have issues with accuracy and reliability). SmartHTC and other SMETERS (smart meter enabled thermal efficiency ratings) appear to be as accurate or more accurate compared to an RdSAP/EPC done by the best assessors and could make HTCs more feasible at scale (see https://assets.publishing.service.gov.uk/media/61f2cc6ee90e0768a90f1f9b/smeter-innovation-competition-report.pdf).

To what extent do you agree or disagree that information based on a heating system metric should be displayed on EPCs? Please select one option for each building type.

Agreement that information based on a heating system metric displayed on EPCs - Domestic buildings:
Agree

Agreement that information based on a heating system metric displayed on EPCs - Non-domestic buildings:
Agree

Salvador Acha:
Agree. Stating the efficiency of the heating system to understand how it sits against other technologies would be very valuable to justify when upgrading the system is justified or not.

Richard Carmichael:
Strongly Agree. An assessment of the heating system is absolutely needed, because space heating and domestic hot water together account for 80% of a typical UK household's total energy use (Palmer & Cooper, 2013) and around 31% of its carbon emissions (Energy Systems Catapult, 2019c).

As far as possible, the actual in-situ performance of that heating system (not the heat pump unit or boiler as an appliance) as installed and operating in that building should be measured, rather than assumed to be operating as per a factory assessment of performance (the Seasonal Coefficient of Performance) or installer predicted efficiency. (Oddly, the installer prediction is what is used for compliance with minimum COPs for BUS eligibility).

Seasonal Coefficient of Performance (SCOP) has been criticised as being inappropriate for predicting the performance of a whole heating system and is likely to overestimate in-situ performance (Meek, 2021; Nolting et al., 2018). This is important because in-situ performance can vary hugely for heat pumps; a heat pump with a Seasonal Performance Factor (SPF) of 2 will cost twice as much to run as one with an SPF of 4.

This performance gap between estimates and actual real-world performance is a known issue for condensing gas boilers, most of which run well below their A-rated efficiency (Alsop, 2021) but, for gas boilers, the variation in efficiencies is very much lower. Data on actual heat pump performance efficiencies would also have value beyond EPCs (including value for heat pump adoption and for DNOs to understand future grid constraints).

Measuring in-situ performance used to be done for many dRHI payments but is not required for BUS. Measuring in-situ performance of heating systems is also complex and a like-for-like comparison would have to control for occupier behaviour and weather during measurement periods).

All references in https://www.imperial.ac.uk/energy-futures-lab/reports/briefing-papers/paper-10/
Smart meter consumption data could provide a reasonable measurement-based assessment of heat pump running costs (even if the heat pump is not sub-metered to separate it from whole house power consumption).

What are your views on the definition, design principles and the scope for a smart readiness metric?

Salvador Acha:
It is of paramount importance to provide details on the control/monitoring capabilities of the heating system so the owners/operators can be well-informed about the energy saving opportunities that exist.

Richard Carmichael:
Strongly agree with the importance of a smart readiness metric. Scope for flexibility should be a key part of the metric or a flexibility metric should be included alongside it. DSR impacts consumer bills, grid carbon intensity and energy security, so EPCs should show not only how energy-efficient UK homes and buildings are but also their scope for being flexible in the time of electricity consumption from the grid.

Demand for heat is ~80% of domestic energy demand (Palmer & Cooper, 2013 – as above). One thing perhaps not included in the proposals is the need to consider the building performance in terms of its ability to retain heat (allowing a heat pump to be turned down or off during peak evening demand period).

How long heating can be turned down will depend on how quickly a building cools down (and heats up) which involves heat loss PLUS the thermal mass of the building. This is not currently assessed in RdSAP and is not easy to define without measurement. The Energy Systems Catapult and Centre for Net Zero Smart Building Rating proposal for a rating expressed as a fraction of each dwelling's maximum theoretical potential presents challenges in deciding how that potential would be determined.

A home with an EV and large home battery they could provide grid services way beyond the norm or their consumption profile, for example. An absolute value of DSR would be likely to be more meaningful for occupier financial rewards (paid per kWh of DSR) and for DNOs and others. It is important to include the responsiveness and duration of DSR offered (which would likely have a different financial value to the energy system and therefore potential for customer rewards). This has huge potential complexity and many aspects.

One option could be to have a point system (as CCC proposed for heating system technologies) whereby, for example, points are awarded for: having a smart meter; having a heat pump that can modulate; how many kWh of battery storage owned (more points for capacity beyond the homes base consumption needs); having solar PV installed; having an EV with smart charging (and extra if it's a V2G bi-directional charger); points if the home retains heat longer; points if the home heats up quicker (these may well be in conflict but both reflect ability to turn down heating during peak periods without loss of thermal comfort); etc.

If the metric is to be based on stress-testing, then it is important to test the value of the metric to different stakeholders under the most likely or critical scenarios (eg. Summer/winter evening peak; Dunkelflaute scenario etc). One important use case would be testing if the metric would help guide consumers towards flexibility-enabling technologies and the TOU tariffs that would incentivise them to actually deliver the flexibility they are able to provide (see Smart Tariffs-Smarter Comparisons project report). The metric could also be of use to DESNZ as an indicator within their Smart Systems & Flexibility Plan Monitoring Framework (https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021) and for monitoring energy security.

To what extent do you agree or disagree that information from an energy use metric should be displayed on EPCs? Please select one option for each building type.

Agreement that information from an energy use metric displayed on EPC - Domestic buildings:

Agreement that information from an energy use metric displayed on EPC - Non-domestic buildings:

Richard Carmichael:
Neither agree nor disagree. It is not clear if the 'energy use' and 'consumption' figures will be actual (e.g. metered) usage. If so then this will be affected by variation in occupant behaviour/preferences, occupancy patterns (e.g. working from home and holidays), appliances (e.g. EV charging adding to consumption, or missing out wood fuel) and weather conditions, and would not allow fair comparison between homes.

The metric should instead be a calculation of the energy required to maintain an adequate indoor temperature for that house and run the house otherwise. (The LILEE and Fuel Poverty Gap metrics include modelling the energy costs required to adequately heat a home, rather than actual energy consumption). Since the vast bulk of domestic energy use is typically for heat this could end up being very similar to the fabric efficiency metric and therefore redundant.

The actual metered power consumption does have some value for other metrics, such as being a proxy for heat pump efficiency that is otherwise a big unknown (see SMETERs and heat pump efficiency comments). It is also good to show consumption (not in a prominent position on the EPC) as a check on other metrics.

If an energy use metric is to be displayed on Energy Performance Certificates (EPCs), which type of energy use measurement should be used to calculate this metric? Please select one option for each building type.

If an energy use metric is to be displayed on Energy Performance Certificates (EPCs), which type of energy use measurement should be used to calculate this metric - Domestic buildings: Delivered energy

If an energy use metric is to be displayed on Energy Performance Certificates (EPCs), which type of energy use measurement should be used to calculate this metric - Non-domestic buildings: Delivered energy

Richard Carmichael:
'Delivered energy' is the best option, but there is also the issue of actual energy usage (eg. metered) vs a more like-for comparison based on energy requirements to maintain adequate thermal comfort. The LILEE and Fuel Poverty but Gap metrics, for example, model the energy costs required to adequately heat the home, rather than actual energy consumption.

To what extent do you agree or disagree that information from a carbon based metric should be displayed on EPCs? Please select one option for each building type.

Agreement that information from a carbon based metric should be displayed on EPCs - Domestic buildings:

Agreement that information from a carbon based metric should be displayed on EPCs - Non-domestic buildings:

Salvador Acha:
Disagree for domestic buildings; it does not seem necessary as long as government promotes low-carbon/high-efficiency technologies. Agree for non-domestic buildings.

Richard Carmichael:
Strongly agree. People need all of cost, consumption, and carbon information to make decisions. Awareness of the different carbon impacts of gas boilers and of the benefits of switching to heat pump is very low.

Many heat pump early adopters were highly motivated by carbon savings and they should be able to see and to show the impact of their investment. It would also be harder to recommend heat pumps and energy efficiency measures for buildings without being able to refer to carbon savings and metrics/ratings.

Carbon factors for electricity (and other fuels) would ideally be updated more regularly. The problem of EPCs of different ages using different carbon factors might be addressed by having EPCs online allowing ratings/scores to updated automatically when factors change.

To what extent do you agree or disagree with incorporating smart metering technologies, like SMETERS, into the energy performance assessment framework for buildings? Please select one option for each building type.

Agreement with incorporating smart metering technologies, like SMETERS, into the energy performance assessment framework for buildings - Domestic buildings: Strongly agree

Agreement with incorporating smart metering technologies, like SMETERS, into the energy performance assessment framework for buildings - Non-domestic buildings: Strongly agree

Richard Carmichael:
This is important both because (a) more measurement-based assessment and compliance is needed and (b) SMETERS appear to be accurate and potentially feasible at scale. SmartHTC and other SMETERS (smart meter enabled thermal efficiency ratings) are as accurate or more so than an RdSAP/EPC done by the best assessors and could make HTCs more feasible at scale (see https://assets.publishing.service.gov.uk/media/61f2cc6ee90e0768a90f1f9b/smeter-innovation-competition-report.pdf).

However, the metrics for consumption, cost, and carbon would need to combine HTC measurement with some modelling to allow like-for-like comparisons, to remove the effect of variation in occupier behaviour such as over/underheating.

Do you have any views on key transition issues?

Salvador Acha:
It will be important to agree the metrics with industry, to ensure compliance and buy-in.

Richard Carmichael:
The metrics should be cocreated and road-tested with users/stakeholders and the benefits should be communicated on launch. They need to be made as easy as possible for users and should maximise benefits. Automatic updates in digital online EPCs should ne enabled and fees for renewing an EPC should be reduced/waived if work has been done to improve a property (to ensure the cost of mandatory EPC renewal is not a barrier to doing more energy efficiency investments). IT should be ensured that there are no bottlenecks in accessing new EPCs for example by training enough assessors (if needed) to manage the timeline for switching over to new EPCs.

When EPCs and DECs are required

What should be the validity period for Energy Performance Certificate (EPC) ratings?

10 years

Kate Simpson:
A new EPC should be provided after any change to the fabric, heat, electric, ventilation or energy

supply or when the property changes hands. 10 years might be too long but could be a backup option.

Richard Carmichael:
Several issues, listed below, need to be considered with respect to the purpose and intention of EPC validity periods, and decisions about changing them.

(1) If we change EPCs and methods then comparing old and new EPCs will be difficult. In that case a short validity period should be put on old EPCs in order to start accumulating a consistent dataset (e.g. declaring all old EPCs invalid after the end of 2025).

(2) If shorter validity periods are also an attempt to keep EPC data up-to-date then it would be sensible to just mandate updates when some work is done to the building rather than waste the effort of getting EPCs re-done that will just reproduce the same result, for example when a property is sold but no work has been done). Ideally, this update should not always require the full assessment to be redone. If a smart meter is fitted, for example, this could trigger an update to the Smart Readiness metric, not a full reassessment.

(3) There is also the problem of dwellings that have never had an EPC and so undermine datasets of value for energy security policy. EPC datasets are incomplete and out-of-date: 31% of residential dwellings in England (34% in Wales) have never had an EPC [ONS. Energy efficiency of housing in England and Wales: 2024 2024:1–18. https://www.ons.gov.uk/peoplepopulationandcommunity/housing/articles/energyefficiencyofhousinginenglandandwales/2024#coverage-and-representativeness].

An alternative question is therefore how to capture those eg. by making EPCs mandatory for all homes or mandating them under a broader set of conditions.

(4) A better approach to validity periods might be to go more the route of Building Passports where changes are logged and building data is updated automatically and/or routinely. The Green Finance Taskforce (2018), the CCC (2020d), Green Finance Institute (GFI/CEEB, 2021), Environmental Audit Committee (2021a) and several witnesses in the inquiry on EPCs (BEIS/MHCLG, 2020b) have all supported the introduction of Building Renovation Passports (BRPs) as a successor to Energy Performance Certificates.

For references and discussion see Carmichael, 2022, at https://www.imperial.ac.uk/energy-futures-lab/reports/briefing-papers/paper-10/.

All of the above are also affected by how costly and labour-intensive an EPC renewal is, including how much an EPC assessment can be automated vs requiring a home visit by a human assessor. There is a strong case for fewer human assessors doing estimates and more measurement being made using SMETERs and similar; the latter should be cheaper.

To what extent do you agree or disagree that a new EPC should be required when an existing one expires for private rented buildings?

Salvador Acha:
Disagree. If the tenant remains the same a new EPC should not be necessary. A new EPC should only be requested if the building is upgraded (e.g. fabric, windows, heating system, smart metering, etc.).

Richard Carmichael:
Agree. This touches on the topic of validity periods. Renting a dwelling should trigger an EPC, but it shouldn't need renewing unless some work is done to the building (that could be getting smart meter fitted/new heating system/insulation/etc).

To what extent do you agree or disagree that the regulations should be amended so that a property must have a valid EPC before it is marketed for sale or rent?

Richard Carmichael:
Buyers and renters need to know what they are getting. See also above comments to Q15 and 14. Any home sold or rented should have a valid EPC (expiry period to be determined). The trigger for renewing an EPC should not be simply a sale/rental but a new EPC should be required if any major works are carried out.

All EPCs should also be renewed as soon as possible if/when EPC methods change substantially; that would mean renewal is triggered by sale/rental unless they already have the new-style EPC. Again, the design and implementation of the above aims should depend on the cost of renewing EPCs and enforcing them (including the unwanted effect of a new EPC becoming a cost barrier to small home improvements/getting a smart meter etc).

To what extent do you agree or disagree that houses in multiple occupation (HMOs) which don't already fall under the (Minimum Energy Efficiency Standards) MEES should do so when a room is rented out?

Salvador Acha:
Neither agree nor disagree.

Richard Carmichael:
Agree. If it is cheap to get an EPC (under new methods) then mandate it. If the current fee would be charged then the case is weaker, though it remains a concern that some lodgers/renters could be in accommodation with terrible heat loss and expensive heating systems.

To what extent do you agree or disagree that there should be a transitional period of 24 months to allow HMO landlords to obtain a valid EPC and comply with MEES regulations?

Richard Carmichael:
24 months sounds rather long, especially if we are trying to get the reformed EPCs in use. Perhaps the necessary period depends on what EPC methods are deployed; there may be bottlenecks in relation to training of human assessors for example and would not be desirable to rely on poorly trained assessors.

To what extent do you agree or disagree with requiring short-term rental properties to have a valid EPC at the point of being let?

Agree

To what extent do you agree or disagree with requiring short-term rental properties to have a valid EPC irrespective of who is responsible for meeting the energy costs?

Agree

To what extent do you agree or disagree that we should remove the exemption for landlords from obtaining an EPC for buildings officially protected as part of a designated environment or because of their architectural or historical merit?

Agree

How useful do you find Display Energy Certificates (DECs) for understanding and improving a building's energy performance?

Somewhat not useful

What alternative approaches, if any, could drive energy performance improvements more effectively than DECs for public sector buildings?

Richard Carmichael:
Support peer-to-peer learning between public sector building managers by enabling them to share data etc. This could include making case studies of public sector buildings available for other public sector building managers to look at and compare energy costs/carbon/consumption before and after energy efficiency improvements.

EPC and DEC data

To what extent do you agree or disagree that data gathered in previous EPC assessments should be available for use in future EPC calculations for a dwelling?

Agree

What are your views on the approach to using existing data, while balancing accuracy and practicality?

Salvador Acha:
Existing data should be complemented by contextual data about the property. Only existing data that is sound and justified should be made available.

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