From Guesswork to Measured Reality:

A National Measured Performance Standard for UK Homes

KNAUFENERGY solutions

Helping you make homes warmer, safer, greener.

Executive Summary

The UK stands on the threshold of one of the most significant investments in home energy performance in decades. Whether through the Warm Homes Plan, new requirements for healthier homes, improved new-build standards, or incentives for low-carbon heating, the collective ambition is clear: homes that are warmer, healthier, and more affordable to heat.

Yet the UK continues to make critical decisions in the dark.

Most judgements about a home's energy performance are still based on survey-based values rather than on measured reality. For a typical home, the expected space heating demand—the amount of energy required to keep it warm—is derived from models and assumptions that rarely reflect how the building actually performs.

This disconnect has consequences. Retrofits deliver inconsistent outcomes. Heat pumps are mis-sized. New builds fall short of their design intent. Households may see little improvement in the cost of heating their homes, even after renovation. Fundamentally, homeowners, asset owners, contractors and policymakers lack the feedback loops needed to ensure public investment is achieving its aims and that energy efficiency is being delivered.

The good news is that the country now has a way out of this blind spot.

Independent studies—from Energy Systems Catapult, Buildwise, KES's own large-scale validation work, and now Leeds Beckett University (LBU)—have demonstrated that in-use building performance can be measured accurately, at low cost, and in occupied conditions. The latest verification from LBU confirms what this evidence base has increasingly shown: the KES SMETER methodology is robust, accurate, and ready for large-scale deployment.

Together, the evidence points to three clear truths:

1. The UK is effectively blind to real home energy performance.
2. The technology now exists to determine real space heating demand accurately and independently.
3. This capability is operational, proven, and ready for scale.

Measured performance represents the shift from assumptions to reality—an essential evolution for the UK's housing, energy and climate goals.

1. The UK's Persistent Blind Spot

For all the progress the UK has made in housing and energy policy, it continues to operate without knowing how homes actually perform. EPCs and SAP models were never designed to measure real energy performance, yet they have become the default basis for decisions affecting billions of pounds and millions of homes. And whilst HEM is signaled as a major step forward it will not, and was not intended to, deliver an improved view of the actual energy performance of a home.

The implications are wide-ranging: retrofit programmes are planned without insight into true performance gaps; heat pumps are sized using assumed heat demand; new builds pass compliance tests yet it's unknown whether they deliver the promised thermal performance; and households are left navigating uncertainty around energy bills and comfort.

Case in Point: As part of a multi house study looking into nearly new build homes, measured performance showed that on average the homes had a space heating demand that was 250% higher than predicted by the EPC; for a gas heated home, this would amount to an additional cost of heating, over 30 years, in the region of £12,000 In addition, by simply redoing the loft insulation, with a strong attention to detail, an average improvement of 14% was measured.

2. A New Capability: Measuring Real Space Heating Demand

The UK now has a reliable, scalable method for determining the true heating demand of an occupied home. Moreover, this method can either provide a normalized space heating demand, for typical household usage patterns, in the same way as is done for Energy Performance Certificates.
Space heating demand reflects the combined influence of insulation quality, airtightness, ventilation, thermal bridges, thermal mass, and heating system efficiency.

KES's SMETER method uses high-resolution data from smart meters, indoor environmental sensors, and heating system output when available. It observes how a house responds to cold weather in normal living conditions and uses advanced analytics to estimate the building's underlying thermal performance.

Later in this paper, the concept of the Heat Transfer Coefficient (HTC) is introduced, which provides the physics-based foundation of measured performance. For policymakers, the key point is simple: we can now quantify how much energy each home genuinely requires to stay warm—based on evidence, not assumption.

3. Evidence Base: A Convergence of Independent Studies

This capability has been validated by multiple independent organisations and by Knauf Energy Solutions' own internal 'blind' evaluation.

As part of the UK Government's SMETER programme, KES technology was evaluated against the gold standard co-heating tests and was shown to be highly accurate. At the time, it was only possible to test KES's technology against a limited number of homes.

However, this work has now been extended through an independent study carried out by Leeds Beckett University, who have confirmed on a larger sample of homes, the original results.

This work builds on previous independent studies carried out by Energy Systems Catapult in the UK and Buildwise in Belgium. Both these independent studies confirmed that KES's technology can deliver an accurate blind estimation of heat demand.

As part of its own going work, KES continually verifies its own accuracy levels through an internal blind energy estimation, similar to the studies carried out by Energy Systems Catapult and Buildwise. These internal verification checks align closely to the results from the independent studies, reinforcing the confidence that this challenge (i.e. the ability to accurately measure the actual energy efficiency of homes, at scale) has been cracked.

Case in Point: In a series of homes in the North West of the England, failed cavity wall, loft insulation and empty party walls were leading to complaints from residents due to high heating bills and cold homes. In this project, the cavity and loft insultation were replaced and the empty party walls were filled. Whilst the EPC suggested hardly any change was made to the space heating demand of these homes, KES technology measured an average improvement to home efficiency of 34% across these homes.

4. Technical Validation: What LBU Confirmed

LBU examined the accuracy of the KES method across occupied homes, comparing in-use measurements with coheating tests—the gold standard for quantifying building thermal performance.

The study demonstrates that in-use measurement is sufficiently reliable for policy design, retrofit verification, new-build assurance, and heating system specification.

The conclusions from this report are:
"The interim results of this verification study show that the KES SMETER technology is capable of calculating a value for the HTC of a home that is in good agreement with the HTC derived from the electrical coheating test. "

The study evaluated the accuracy of KES' different offers, measured as CVRSME, in the range of 5% for the premium data product and 12% for the reduced data version. These match or exceed earlier SMETER trials, with the premium data product (which includes heat meter data) demonstrating a much higher level of accuracy.

Our premium data product includes a heat meter, which allows KES to account for the efficiency of the heating system in the house. This improves accuracy for gas heated homes but is essential for houses with heat pumps, given the potential large variation in the efficiency of a heat pump. This also means that when KES monitors homes with heat pumps, in addition to the space heating demand of the house, we also obtain a measured in-use sCOP for the heat pump.

5. Implications for UK Housing and Energy Policy

Measured performance transforms decision-making across the housing system.

For the Warm Homes Plan, it enables funding to be targeted towards homes with the highest genuine need, verifies delivered outcomes, and de-risks heat pump deployment. For homeowners, it offers clarity on whether interventions will genuinely reduce bills. For developers and regulators, it provides a way to assess as-built quality. For the whole building chain it finally delivers the evidence that energy efficiency measures have delivered real outcomes, allowing the market to properly value quality.

Case in Point: Across a 64-house project, in Belgium, a measured understanding of the space heating demand demonstrated that the heat pumps had been oversized and that it was not necessary to replace radiators, making important cost savings.

6. The National Opportunity: A Measured Performance Framework

Whilst some have highlighted the need to replace EPCs and SAP and even the new HEM before it arrives, this is not what this white paper is advocating.
The most important challenge that these frameworks face, is the difficulty to measure the real space heating demand and thus the HTC of a home, whether it be for renovation, new build or sizing heating systems.
Integrating measured HTCs into these frameworks would already provide a major step forward towards an improved approach to energy efficiency measurement. In such cases, the idea is not to replace existing tools but to augment them, when possible, with measured HTCs.
The UK government is already working on a validation and certification approach for SMETERS and with some additional impetus, it must be possible to provide a trusted

framework for these technologies to support the UK to deliver warm homes.

7. Technology Ready for National Scale

The decisive question is not whether measurement is accurate—this is now firmly established—but whether it is ready for deployment across millions of UK homes. It is.

KES has already deployed the end-to-end system required for large-scale operation: sensors built for real homes, secure data infrastructure, advanced analytics, and a platform that converts raw data into actionable insight. Hundreds of thousands of data points, in homes in the UK and abroad, across varied housing types have been monitored, proving the maturity and resilience of the method.

The KES platform includes a number of elements targeted at large scale deployment, including:

- **Ease of Use:** After years of deployment in real homes, we have built a system that makes deployment as easy as possible. Using battery operated sensors and plug and play self-service onboarding tools, the system is easy to install and the base system does not need any specialized support from plumbers or electricians. Typical install times now being in the region of 20 minutes.
- **Security and Privacy:** As KES is a full stack IoT provider, from sensors, to cloud, to AI, we are able to build with security and privacy in mind. We develop the hardware and the software and so control the data journey.

Case in Point: A 184 house retrofit project used KES technology to monitor pre and post retrofit quality. This data supported the social housing company to not only choose the right retrofits but also to demonstrate that the work delivered the expected results.

8. Pathway to Scale: What the UK Should Do Next.

A national measured performance capability requires very little to make it a reality.

Technology, whether it be that of KES or other providers, exists and can support a national scale up.

What is needed is government to act in two specific areas.

The first is to complete the process as soon as possible to validate and certify the SMETER technologies that already exist and can demonstrate the necessary level of accuracy.

The second is to create pathways into existing legislation to allow SMETERs to play a role in supporting much higher quality. This could be as simple as allowing approved SMETER technologies to integrate their measured HTCs into the EPC framework or expecting a percentage of new build homes to be measured using SMETERs post occupation.

Given the growing evidence that SMETERs are ready to support policy right now, the above processes should move ahead in parallel. Legislation is not updated every year but IoT and AI technology is marching forward every month.

It is key that the Warm Homes Plan provides pathways for SMETER technologies, even if these pathways are conditional on validation and certification.

The important thing is to start the journey.

9. Conclusion

The UK now has a proven, independently validated method to understand how homes actually perform. Measured performance enables policymakers, industry and households to make decisions based on evidence rather than assumption.

It offers a pathway to warmer homes, lower bills, more reliable retrofits, better new-build quality, and more effective climate action. The opportunity is immediate. The capability exists. The case is clear.

The time has come to move from guesswork to measured reality.