UK Government

Smart Meter Enabled Thermal Efficiency Ratings (SMETER)

An introduction to SMETER and its applications

Department for Energy Security and Net Zero (2026)

Contents

Purpose of this guide

This guide is aimed at housing providers, particularly local and combined authorities and housing associations. It seeks to inform them about the potential for SMETER measurement to help deliver energy efficient homes, in the context of the wider adoption of environmental (e.g. humidity) sensing in social housing. The guide may also be of interest to others, including large commercial domestic landlords and property-linked finance providers.

1. Introducing SMETER

The rationale for measuring homes

The government is committed to working with local government and other partners to decarbonise and improve the energy efficiency of UK homes, delivering warm, healthy homes and lower bills. To achieve these goals, we need to consistently and cost-effectively deliver the right outcomes for millions of individual homes.

Very little measured data on actual outcomes, such as internal temperatures, humidity (hence mould risk), air quality and heating costs has historically been available to those managing the housing stock. This has been an obstacle to delivering our goals consistently and in a targeted way.

However, there is an ongoing transformation in the availability of digital data about our homes. Smart meters, thermostats and other sensing devices are now widely installed and expected to spread further. 72% of home energy meters are now smart and 20% of homes have a smart thermostat[1]. Many housing providers are investing in environmental sensing, in part in response to Awaab's Law[2]. These devices are making available, at increasing scale, data on gas and electricity consumption, room temperatures, humidity and indoor air quality.

Measuring heat losses through SMETER

Delivering goals for energy efficiency is generally guided by Energy Performance Certificate (EPC) information. However as revealed through multiple recent studies[3], there can be a substantial 'performance gap', between heat losses and heating costs actually incurred and those predicted by the models used at present, which largely assess buildings as-designed rather than as-built. There have also been relatively few studies into the outcomes from energy efficiency upgrades.

[1] DESNZ (2026) 'Smart meters in Great Britain, quarterly update March 2026'; Aviva (2025) 'How we live: Executive report'
[2] Hazards in Social Housing (Prescribed Requirements) (England) Regulations 2025, commonly referred to as Awaab's Law
[3] See the accompanying annex to this guide, 'SMETER case studies and evidence base'

As a consequence, it can be hard for homeowners, housing associations and local authorities, residents and other parties to know whether homes are currently performing well or badly, what upgrades are needed, and afterwards if they are delivering the expected results.

New technologies have been developed to measure the thermal performance of homes using energy and temperature data from the property; these are collectively termed Smart Meter Enabled Thermal Efficiency Ratings (SMETER). SMETER methods focus on the heat transfer coefficient (HTC), which is the average rate at which a building loses heat. This is useful to compare the relative efficiency of homes and to predict heating costs. SMETER can account for elements of the home that physical surveys and models of thermal performance that do not use direct measurement cannot.

SMETER's relationship with other types of sensing

SMETER can draw temperature data from a wide variety of devices (dedicated sensors, energy displays, smart thermostats and other connected devices in the home) meaning that they can be supported by environmental monitoring systems being installed for other purposes, such as to identify properties at risk of mould.

There is also a range of other building performance technologies including rapid U-value measurements, 3D home energy modelling with LiDAR, infra-red sensor data recommendation engines and others. SMETER can complement these technologies: for example, where excessive heat loss is identified, infra-red surveys and U-value measurement could be used in follow-up investigations, to target specific interventions.

Why this guide focuses on SMETER

This guide focuses on SMETER due to the overall importance of heat losses; the technology's relatively high level of maturity and increasing evidence base[4]; and, crucially, its ability to integrate into existing information systems, which could incorporate measured HTC to inform decisions and funding mechanisms. Such integration should make a future transition to greater use of measurement easier and less disruptive.

In the Warm Homes Plan[5], the government reiterated its commitment to supporting the development of SMETER and the exploration of its applications in policies. The government has consulted[6] on a voluntary option to record validated and quality assured SMETER HTC values on EPCs, alongside an HTC calculated by the Home Energy Model. DESNZ is developing SMETER validation and quality assurance systems to support this and other applications. SMETER methods are also increasingly being recognised as important in stakeholder proposals for improving the delivery of net zero homes.

All these features mean that they have transformational potential across the housing, energy efficiency and home heating space.

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[4] See the accompanying annex to this guide, 'SMETER case studies and evidence base'
[5] DESNZ (2026) 'Warm Homes Plan' page 93
[6] DESNZ (2026) 'Home Energy Model (HEM) methodology for assessing existing dwellings and producing new Energy Performance Certificates metrics'

What is an HTC and why is it important?

In this guide we particularly focus on the heat transfer coefficient (HTC). The HTC measures heat losses relative to the inside/outside temperature differential[7]. Buildings lose heat through two routes:

- transmission losses through the fabric of the building, such as walls, roof, floor and glazing
- ventilation losses, both intentionally through extractors, trickle vents and windows, and unintentionally through gaps in the building fabric

The HTC represents the thermal performance of the fabric in a home and also has a direct relationship with the amount of heat required to keep it warm. HTC can be used as an input to models for predicting heating and energy requirements and costs, whether over the whole year or for the peak winter heating demand.

Prior to SMETER becoming available, HTC could either be measured through an expensive and intrusive 'co-heating test' process requiring the home to be unoccupied; or calculated using survey data and simplified assumptions. Both of these methods have advantages for some purposes but also disadvantages for assessing the real performance of lived-in homes; these are addressed by SMETER.

How SMETER approaches work

SMETER (Smart Meter Enabled Thermal Efficiency Ratings) is an umbrella term that is used for technologies that measure the overall thermal performance of buildings whilst they are occupied, over a period of time, which may be a week or much longer. Most of these technologies use energy consumption and weather data, internal temperature sensors (important for accuracy at dwelling level), as well as some basic details about the home itself to determine the HTC value, which is the main output from SMETER monitoring.

Several commercial SMETER technologies are available to use in individual homes. Costs of current SMETER offerings start at £10 and go up to several hundred pounds per home, depending on whether existing sensors are already available, the number and complexity of homes being measured, and the product and package selected.

[7] For a technical definition of HTC, see DESNZ (2022) 'Technical Evaluation of SMETER Technologies (TEST) Project', page 8: "The HTC is a widely recognised metric for describing building heat loss expressed as the rate at which heat is lost per degree Celsius air temperature difference between the inside and outside of a building in units of W/K."

For housing providers, installing SMETER sensors across their whole stock on a property-by-property basis could be slow, but where temperature sensors are already being installed in thermostats or other devices, this may offer quicker routes. Pilot work[8] has also examined the scope for 'remote' methods, which do not require a home visit or internal temperature sensors. It has also been suggested[9] that SMETER HTC for representative samples of housing in an area could be integrated with EPC and remotely measured data (LiDAR, thermal imaging) to provide better predictive models for archetypes in that area, as a means of scaling up. Further research is being considered to develop such methods.

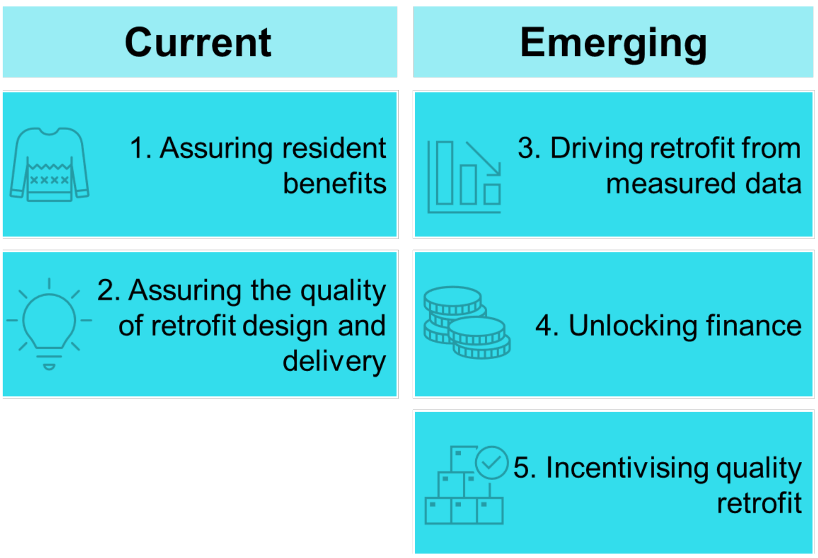
Relationship of in-use HTC with modelled metrics

SMETER measurements complement Energy Performance Certificates (EPCs) and other survey-based methods. EPCs provide ratings on the performance of homes, underpinned by a calculation model which predicts the energy performance in the home based on assumptions about the home, including the absence of major defects and that retrofits are correctly installed. Comparison of EPC and SMETER heat loss estimates can provide information on whether the home is performing as it should be.

Strategic opportunities and impacts

The introduction of performance measurement opens up a wide range of new opportunities. SMETER can lever environment monitoring initiatives, such as are being developed by housing providers following Awaab's Law, for further benefits. We anticipate that the opportunities will play out over the coming years, as technologies improve and new applications are found: hence, an early understanding of their likely impacts should be helpful to decision takers. This section briefly summarises key areas of expected impact as shown in Figure 1.

Figure 1: key areas of expected strategic impact



[8] DESNZ (2025) 'Green Homes Grant (GHG) SMETER project: final report'
[9] Arup and National Retrofit Hub (2026) 'Data and technology: Strengthening our understanding for better retrofit outcomes', page 20

Current strategic benefits

1. Assuring resident benefits

Measurement can:

- verify that the installed measures are appropriate and sufficient to achieve a warm home at reasonable cost
- support different types of advice on use of retrofitted homes and heating systems and ventilation

Measurement can thus directly help to ensure that the intended outcomes are delivered to householders.

2. Assuring the quality of retrofit design and delivery

Measurement can help to inform the choice of appropriate retrofit measures for different property types and then validate that the desired outcomes are achieved.

Emerging strategic benefits

3. Driving retrofit from measured data

Once SMETER measurements are available at greater scale, there is potential for in-use HTC measurement, and cost and other metrics derived from it, to provide the main information source for planning and reporting retrofit programmes. Large-scale SMETER measurements could also improve other planning processes, such as Local Area Energy Plans and electricity networks reinforcement.

4. Unlocking finance

Measured data on the performance of retrofit projects can underpin private finance, e.g. to support finance applications and demonstrate retrofit outcomes.

5. Incentivising quality retrofit

By enabling the actual performance of interventions to be demonstrated, the retrofit supply chain can be rewarded for designing and installing retrofits to a high standard while being held to account by housing providers where installations are substandard.

Insights from housing providers

Participants at a March 2026 workshop organised by DESNZ jointly with the Healthy Homes Hub on SMETER HTC and EPC Reform suggested that measuring HTC would have real strategic value for housing providers:

> *"It's valuable to me….. The [EPC C] 2030 target is a fuel poverty target and, ultimately, I want to know if a home is cold or not (based on fabric performance). HTC allows me to make informed decisions on this."* (Housing association)

> *"Strategically, it would be useful. We have [50,000 – 100,000] homes and need to make investment decisions at scale about warmth, thermal comfort and insulation. While respecting that every home is different, I would like to measure performance (HTC) in different home archetypes to understand where the biggest challenges are."* (Housing association)

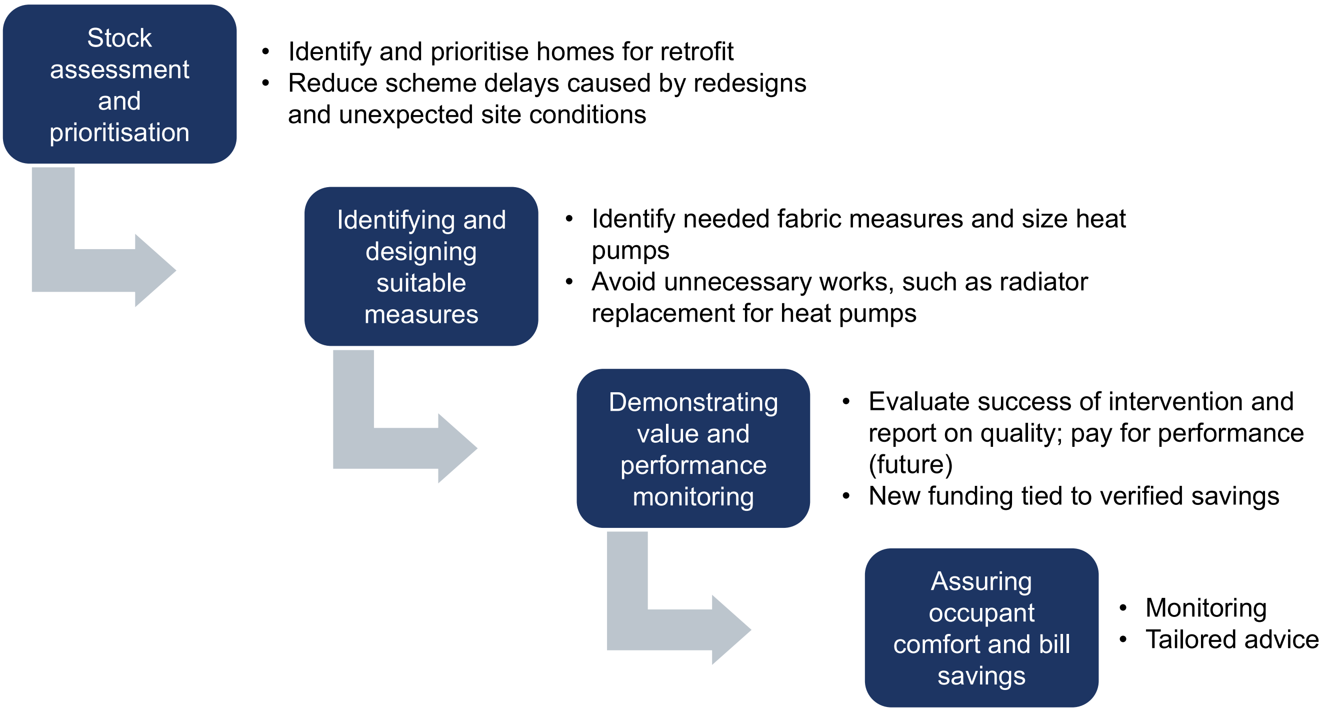
2. The main applications for SMETER

What are the applications of SMETER?

Housing providers and others in the housing industry are already applying SMETER HTC to achieve a range of advantages. Figure 2 summarises a number of applications of SMETER HTC measurement at different stages of home improvement programmes. While SMETER measurement could be applied to a sub-set of these activities (as in the case studies reported on separately), in the future it may be that an integrated approach is commonly taken.

For example, HTC measurements could be applied on specific home archetypes to inform upgrade strategies within a portfolio and then used alongside survey information to identify the best fabric retrofit and size heating measures. Finally, this measurement combined with a further HTC measurement post-retrofit could be used to assess the quality of the installation.

Figure 2: schematic of different SMETER measurement applications



The main areas of application are described in the sections below.

Stock assessment and prioritisation

The SMETER HTC measurement can better target those homes most in need of fabric upgrades. Significant performance gaps may be due to systemic design or construction issues[10], while even homes of the same age and construction may perform very differently. SMETER measurements of sub-samples of different archetypes may identify ones which generally perform better, or worse, than model predictions. When HTC measurements are gathered at scale (for example, across a housing provider's whole portfolio of homes), this information can be useful in prioritising individual homes for retrofit. This may involve addressing hidden defects.

Lloyds Bank, Bromford Flagship and Senze partnered[11] to test whether measured thermal performance data can enable more effective, lower-cost, lower risk retrofit decisions than traditional EPC-based modelling.

Across the 121 homes tested:

- 59% needed upgrading but required fewer interventions to meet EPC C than modelled EPC approaches suggested
- 7% already met EPC C performance despite being rated EPC D
- 13% had undetected poor performance despite already having received significant retrofit investment to reach EPC C

Credit: Bromford Flagship LiveWest

[10] For example, party wall bypass, as described by Jez Wingfield, Dominic Miles-Shenton & Malcolm Bell (2009) 'Evaluation of the party wall thermal bypass in masonry dwellings', Leeds Beckett University (then Leeds Metropolitan University)
[11] Lloyds (2025) 'Intelligent Measured Data. Smarter Retrofit. Better Outcomes'

SMETER HTC together with other survey information can also better target those homes most suitable for heat pump installation. By measuring the fabric performance of the building, it is possible to identify which homes need no or different levels of fabric upgrades in tandem with a heat pump installation to that calculated from basic survey data.

Identifying and designing suitable measures

The HTC on its own cannot identify the best package of building fabric measures. While comparing a SMETER HTC with the HTC estimated using design information is important, if the HTC is poor, it will generally be unclear from the reading alone which fabric element(s) are causing the poor performance of the building.

However, HTC measurement can be complemented by additional information such as infra-red surveys and other measurements to help identify suitable retrofit measures and tailor them to the needs of the building. This may be done with representative sub-samples of a housing portfolio, to identify, for example, archetypes which need a lower level of intervention than predicted to achieve satisfactory performance, or across the whole portfolio to identify, for example, defective properties which need additional measures.

Cambridge City Council has been using pre- and post- retrofit monitoring since 2022 to evaluate social housing retrofit programmes.

Monitoring, including heat transfer coefficient (HTC) measurement in at least 10% of homes each winter, enables comparison across similar housing archetypes to assess performance and cost effectiveness, and inform future delivery. Results show improvements in efficiency, reveal performance variation between similar homes, and have helped identify underperforming systems and ventilation issues.

Overall, the Council views HTC based monitoring as essential for evidencing outcomes, troubleshooting issues, refining specifications, and building confidence before scaling retrofit programmes.

SMETER HTC can also be used to help ensure that a heating system, including a heat pump, provides the right output. Conservative assumptions are often used when sizing heat pumps: measuring the heat loss can reduce the size and cost of heat pump required and/or avoid the need to replace radiators, while also avoiding the risk of under-sizing. Optimising the sizing of the heating system for the home in question can also improve heating system efficiency, resulting in lower fuel bills.

Heat pump installers can use the HTC to calibrate and validate the sizing of a heat pump system. Further, knowledge of the fabric performance can be used by the heating engineer to make the heating system more efficient when commissioning the system (when setting up weather compensation controls).

Build Test Solutions, Veritherm UK and Elmhurst[12] compared measured heat loss with calculated heat loss[13] to determine whether measurements could help optimise heat pump system design. Results from a field trial in 56 homes showed that measured heat losses were different from calculations in 70% of homes. Most homes performed better than expected, suggesting potential to downsize heat pumps and significantly reduce costs.

Optimising the design and installations based on measurements could create an average capital cost saving of around 10% (£450) in homes like these, and households found the measurement process useful and minimally disruptive.

Credit: Build Test Solutions

[12] Build Test Solutions, Veritherm UK and Elmhurst Energy Services Ltd (2025) 'Improving the survey and design process: MEASURED'

[13] Using the BS EN 12831 standard for calculating the design heat load.

Demonstrating value and performance monitoring

Where SMETER measurement is carried out pre- and post-retrofit, it can be used to assess the impact of the retrofit and to compare this with modelled estimates. This can be directly useful to housing providers, either by confirming that the retrofit has achieved the designed improvement in HTC and heating costs, or by identifying issues with the performance of the retrofit measures needing early rectification. Both results will also provide learning for future programme design and delivery.

The **London Borough of Havering**[14] monitored homes retrofitted under the Warm Homes: Social Housing Fund (then the Social Housing Decarbonisation Fund) using Purrmetrix sensors to assess changes in heat loss, comfort and ventilation, finding substantial post retrofit reductions in heat loss alongside warmer homes and/or lower energy bills. The work also showed SAP models often overestimated pre retrofit heat loss, indicating that measured HTC – though not used for measure selection in this programme – could help target future retrofits more effectively and improve value for money.

Credit: LB Havering

Quantifying the impacts of retrofit programmes can also support new models for procuring and funding housing retrofit programmes. These include payment by results and improving access to and performance reporting on net zero finance, based on measured savings.

[14] Purrmetrix (2025) 'Monitoring for retrofit at London Borough of Havering'

In a large-scale social housing retrofit programme[15] delivered for CNUZ in Tienen, Belgium, **Knauf Energy Solutions** achieved an average 37% reduction in energy demand and measurable improvements in indoor conditions, including fewer homes experiencing high humidity, elevated CO_2, or cold daytime temperatures. This demonstrated a new approach to contracting for retrofit programmes, based on results achieved rather than works completed, and involving an integrated, end to end process underpinned by measurement, design and quality assurance processes.

Assuring occupant comfort and bill savings

Environmental monitoring tools that incorporate SMETER HTC can be used to better enable residents to understand and manage the environment within their home. Such tools that give residents greater visibility of the thermal performance of their homes, in a way that is understandable and actionable, have been shown to reduce resident concerns about heating and empower them to use their heating in a way that meets their preferred levels of thermal comfort. This includes advice on thermostat settings and heating controls, ventilation practices and other energy efficiency advice. Having greater understanding and control over their energy usage can help consumers to take steps to reduce their consumption, ultimately saving money on bills.

[15] Knauf Energy Solutions, 'Renovation of 166 social houses achieves 37% energy savings'

3. Further information

This guide has been developed by the SMETER team within DESNZ's Smart Metering Implementation Programme, which is working with other parts of government to support the introduction of SMETER measurements.

The team is contactable at: smeter_project@energysecurity.gov.uk.

Other sources of information

Many sources of information exist on SMETER HTC and the measurement of the thermal performance of buildings. Two new resources are:

SMETER case studies and evidence base report

This annex accompanies the guide[16]. It sets out case studies of SMETER being used for a range of applications, with a focus on those that are relevant to housing providers. It also includes a summary of the scientific evidence on SMETER measurements, including why measured thermal performance can provide information of value and evidence on the accuracy of SMETER methods.

National Retrofit Hub and Arup report on measured HTC

This recent report[17] provides an overview of SMETER HTC and its applications and makes a range of recommendations to government and other parties.

[16] See the accompanying annex to this guide, 'SMETER case studies and evidence base'
[17] Arup and National Retrofit Hub (2026) 'Data and technology: Strengthening our understanding for better retrofit outcomes'

Technical terms

Heat transfer coefficient (HTC)

The rate of heat loss (W/K) through the building envelope (walls, roof, floor, windows) and via air leakage, per degree of temperature difference between inside and outside.

Housing archetype

Classification or grouping of similar buildings used to streamline energy modelling, identify renovation needs, and scale sustainability.

LiDAR (Light Detection and Ranging)

An active remote sensing technology that uses laser pulses to measure exact distances, map environments, and create high-resolution 3D models.

Remote SMETER

SMETER methods which do not require internal temperature measurements and can be applied at scale using smart metering and weather data.

Smart meters

These are the new generation of gas and electricity meters which automatically and securely record energy consumption and send this data to energy suppliers.

SMETER

Smart Meter Enabled Thermal Efficiency Ratings.

Smart thermostat

An internet-connected device that manages a home's heating system, allowing remote control.

U-value

A physical metric of how effectively building materials and elements (like walls, roofs, and windows) conduct heat. It indicates the rate of heat loss through a square metre of a structure for every degree of temperature difference between the inside and outside.

This publication is available from: www.gov.uk/government/publications/smart-meter-enabled-thermal-efficiency-ratings-smeter-strategic-guide

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