# A RISK-BASED FRAMEWORK FOR ACOUSTIC ASSESSMENT OF DOMESTIC ASHPS - REDUCING THE BARRIERS TO ROLLOUT

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## 1 ABSTRACT

The widespread adoption of Air Source Heat Pumps (ASHPs) is critical to the UK's decarbonisation targets, yet their deployment is hindered by a binary and inefficient acoustic approval framework. Installers currently face a "cliff-edge": either a simplified calculation under Permitted Development Rights or a costly, complex full planning application. This rigidity stalls numerous viable installations and hinders the national heat pump rollout.

Previous research demonstrates that the current MCS-020 sound propagation methodology can be excessively conservative, predicting sound levels at receptor locations 5-7 dB higher than the more accurate ISO 9613-2 standard, for example. To address this, we propose a hierarchical, risk-based assessment framework that aligns the complexity of the evaluation with the actual acoustic risk. This multi-layered approach streamlines approval by building on the MCS-020a standard to incorporate the more detailed ISO 9613-2 methodology, and advocating for the acceptance of a fixed 37 dB(A) threshold as sufficient for low-risk installations in planning applications, removing the need for expensive background sound surveys.

This pragmatic framework, drawing on successful models from Scotland and much of Europe where fixed thresholds facilitate efficient assessment, would significantly reduce the burden for low-risk installations. It ensures appropriate acoustic amenity is protected while removing unnecessary barriers, thereby accelerating the ASHP rollout essential for meeting the UK's climate objectives.

Keywords: *ASHP, Noise, Acoustics, Sound propagation, Policy barrier*

## 2 INTRODUCTION

### 2.1 Identifying the Barriers to Rollout to decarbonisation of domestic heating

The UK's commitment to achieving net-zero carbon emissions by 2050 necessitates a profound transformation in how buildings are heated. Air Source Heat Pumps (ASHPs) are a cornerstone of this strategy, representing a mature, efficient, and scalable technology for decarbonising the domestic heating sector. The Government has set ambitious targets, aiming for 600,000 ASHP installations per year by 2030, a significant increase from the current rate of around 100,000 units. Achieving this scale of deployment is critical not only for meeting climate obligations but also for enhancing national energy security.

Despite this urgency, the widespread adoption of ASHPs is being impeded by several interconnected obstacles, which can be broadly categorised as:

- Acoustic: relating to the sound level and character of the units themselves;
- Bureaucratic: concerning the regulatory frameworks governing their approval and installation; and
- Social: encompassing public perception, awareness, and the politicised narratives surrounding the technology. Non-acoustic factors also fall into this category.

While all three aspects together present a significant challenge, the bureaucratic barriers present a tangible and immediate obstacle that can be addressed through pragmatic policy evolution. This paper focuses primarily on proposing a solution to the acoustic and regulatory hurdles, while also considering what social factors may require attention, as ultimately the rollout relies on public acceptance for the wide deployment of ASHP technology.

## 2.2 The Benefits for Sustainability Development

The United Nations's (UN's) Sustainable Development Goal (SDG) provide a good measure for considering the benefits for the delivery of sustainability in a broader way than simply to the net zero agenda and climate change. The interventions proposed for professional guidance supporting approved pathways in place of a case-by-case cliff edge would include delivery on the social focused goals, which include 3 (good health and well-being), 10 (reduced inequalities), 11 (sustainable cities and communities) and 16 (peace, justice and strong institutions) [22].

## 2.3 Building on Previous Work

Previous research has established a fundamental issue within the current UK assessment methodology; this has been presented at the Institute of Acoustics (IOA) Acoustics 2024 [1], CIBSE Symposium 2025 [2] and Forum Acusticum 2025 [3] conferences. This demonstrated, through detailed acoustic modelling, that the simplified calculation method required for Permitted Development Rights (PDR) under the Microgeneration Certification Scheme (MCS 020a [4]) was conservative. These studies showed that, for the typical installation scenario depicted, the MCS 020 method consistently predicted sound pressure levels 5 - 7 dB higher than calculations performed using the more detailed and widely recognised international standard, ISO 9613-2 [5]. This frequently embedded caution in the simplest assessment route, but also created an unnecessary barrier, pushing viable installations into a more complex acoustic assessment and more costly process requiring a full planning application.

In response to the original MCS 020 noise assessment procedure, the IOA and CIEH agreed interim guidance [6]. This embedded the inclusion of a 6 dB character correction for tonality (unless it could be proven not to be needed) and reduced the target rating level to 35 dB(A), evaluated over a 15-minute reference period; that guidance note attempted to integrate the absolute level target from MCS 020 with the rating level approach from BS 4142 [7], albeit in a conservative fashion. The joint guidance was provided in the form of a Professional Practice Note, a Public Briefing Note, and a calculation spreadsheet, available on the IOA and CIEH websites. The status of this guidance is under review and the IOA Renewable Energy Advisory Group (REAG) working group, of which a number of the authors are members, is considering changes following the release of the MCS 020a update in March 2025. This paper is therefore intended to convey the current position of the IOA working group to facilitate discussions with CIEH colleagues and to share that thinking more broadly. The REAG considers the acoustic implications of emerging renewable technology and infrastructure on behalf of the IOA.

## 2.4 Thesis and Contribution

This paper moves beyond identifying the problem to proposing specific and practical solutions: it presents a way forward, and argues that the current binary assessment framework - between PDR on the one hand, and full planning on the other - creates significant and unnecessary barriers to the uptake of ASHPs. The key contribution of this paper is the proposal of a robust, multi-layered, hierarchical framework for acoustic assessment which can, in many instances, be completed without the need for a detailed noise assessment to BS 4142 with a background noise survey, as long as the guidance is followed. The method applies a risk-based approach which aligns the complexity of the evaluation with the acoustic risk of the installation, creating a more nuanced and proportionate pathway to compliance for low-risk domestic installations which does not risk significantly compromising public health. In doing so it embeds the expectations of existing national planning and noise policy [8, 9].

# 3 THE UK'S BINARY REGULATORY FRAMEWORK: A BARRIER TO PROGRESS

A primary regulatory barrier to the accelerated deployment of domestic ASHPs in the UK is the binary nature of the acoustic approval framework that exists currently. Homeowners and installers are presented with two starkly different pathways: a simplified, no-cost route through Permitted Development Rights (PDR), or a full planning application and associated sound (more commonly called 'noise') impact assessment requiring professional input. While the current IOA/CIEH joint guidance aims to offer an alternative route to a full BS 4142 assessment, it currently has more onerous noise constraints than the MCS 020a method. In addition, if local planning authorities (LPAs) are challenged over an installation, they may currently revert to the use of BS 4142, as this is a familiar standard and is written into many local plans and technical guidance of Local Authorities. A clear pathway, backed by the professional bodies and ideally Government, is needed if this is to change and provide commenting Environmental Health Departments with confidence. The potential regulatory pathway differences between installation of a gas boiler and installation of an ASHP are illustrated by Nesta, reproduced in Figure 1.

## 3.1 Path 1: Permitted Development Rights (PDR)

For the majority of straightforward low-risk domestic installations, PDR is the intended and most efficient route through planning. This pathway allows for the installation of an ASHP without the need for a formal planning application, provided certain conditions are met. From an acoustic standpoint, compliance is determined using the methodology set out in the Microgeneration Certification Scheme standard, MCS 020a.

The MCS 020a assessment method is designed for simplicity, to be completed by MCS approved installers who are not acousticians; the method may be unintentionally conservative. It is typically carried out by the installer using the prescribed calculation method, involves no direct cost to the homeowner, and provides a swift go/no-go verdict and is currently required to apply for some Government funding. However, this simplicity comes at a price. The cost is a lack of flexibility. PDR do not apply in all circumstances, such as in conservation areas, for historic monuments or for properties. The result is that homeowners who would like to install an ASHP are then prevented from using PDR by sometimes fine margins or technicalities, forcing them down a more costly, complicated and uncertain pathway.

## 3.2 Path 2: Full Planning Permission

If an installation does not qualify for PDR, either because of location constraints, the number of units, because it falls within a conservation area, or fails the MCS 020a noise assessment, the only existing alternative is to seek full planning permission from the LPA. This shifts the project into a dramatically different bureaucratic regime of cost and complexity, as well as uncertainty of success. LPAs invariably require a formal noise impact assessment and what might be required may vary from area to area, creating a 'postcode lottery'. Most likely the assessment will require use of the assessment methodology within BS 4142. This is a more complex process, requiring the engagement of a suitably qualified acoustic consultant and usually involving a sound survey to measure the existing background sound level at the site. The cost of this assessment alone is often approximately £1,000 - £2,000, in addition to the fees and administrative burden of the planning application itself.

The application of BS 4142 to assess the impact of sound from a domestic heating system is tenuous. In the scope of the standard states, it is intended for "rating and assessing sound of an industrial and/or commercial nature" on "people who may be inside or outside a dwelling or premises used for residential purposes" [7]. It is not intended for rating and assessment of a domestic system and has been applied by convention due to the lack of a specific standard for domestic heating system sources. It is not explicitly excluded in 1.3 of the standards, which could be a clarification in any future

revision. In Scotland, the majority of local authorities apply absolute criteria, such as Noise Rating (NR) curves [10], avoiding the cost of a background sound level survey [11].
This route introduces significant friction to the process with uncertainty and delays, with stakeholder evidence from government reports [12] confirming that many installers and energy providers will rather abandon projects that require planning permission, due to these prohibitive factors.

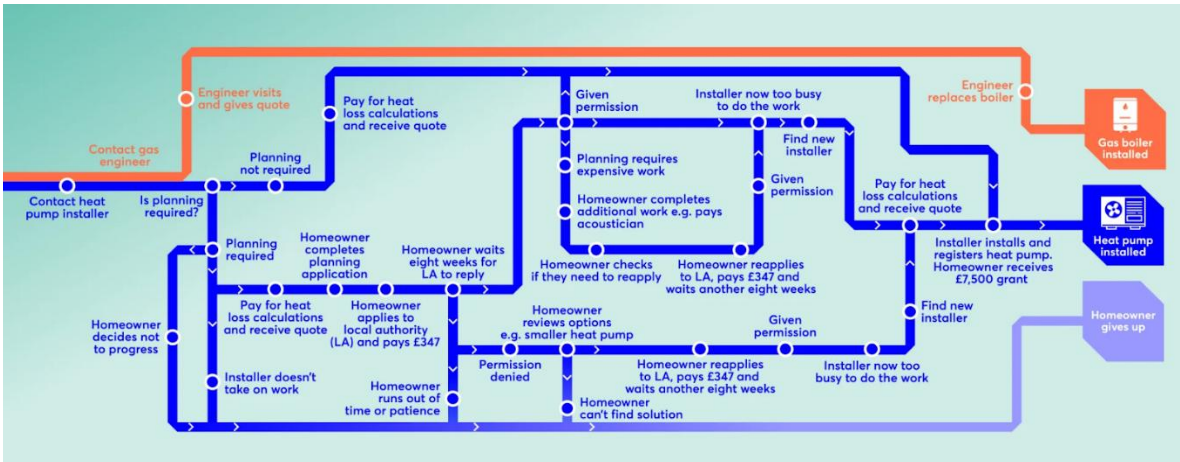


***Figure 1: Planning approval pathways: Orange = gas boiler installation pathway, Blue = ASHP installation pathways. Source: Nesta***

## 3.3 The "Cliff-Edge" Problem

The chasm between these two pathways creates the central bureaucratic barrier to rollout, with a void on the planning side from which many installations do not emerge. An installation that fails the MCS 020a assessment by even a single decibel is pushed over a "cliff-edge" from a free, installer-led check into a costly, expert-led planning process. This may suggest that a risk exists that could be addressed by the profession, but the reality is that with the potential 5 – 7 dB of conservatism within the MCS 020a calculation procedure there is scope to provide proportional guidance without significant additional risk existing. This means that a significant number of installations that would have failed using the current MSC 020a method, despite potentially having an acceptable real-world acoustic impact in normal operational conditions, are not being unnecessarily subjected to a burdensome and expensive approval route. The current binary system lacks proportionality and presents an unnecessary barrier to the rollout of a technology that is critical to the UK's decarbonisation strategy without a clear reason for doing so: no similar noise assessment is required for a gas boiler or extract fan, for example, which also produce sound. One concern is that the cumulative impact of future capacity for conversions to ASHPs have occurred and that the impact will be unacceptable.

## 3.4 Cumulative Impact

The future total change to the ambient sound level needs consideration and can be predicted and included as part of any assessment. This is necessary as the acoustic capacity (meaning in this case the total sound resulting from full deployment in the area using similar systems) should not exceed the prescribed sound target. Often distance alone will achieve this, but where proximities are close and options for installations are limited this is intended to preserve the equity of the neighbouring properties to be able to install a similar system. This can be completed as a feasibility exercise using the same calculation method from the most likely worst-case position for a neighbouring properties installation and adding the resulting sound levels from installations together at each noise sensitive receptor position. By not exceeding the fixed 37dB(A) threshold this demonstrates that planning and noise policies would be likely to be satisfied as a cumulative sound level, without the need for additional mitigation. If that is not the case then mitigation or reselection of the units may be necessary to preserve that equity so as not to burden neighbouring properties with the need to include mitigation which they otherwise would have had to. Initial work commissioned by NESTA suggests that this may not generally be as much a concern for architypes such as semi-detached and terraces in places where background levels are not low however [13].

This paper aims to provide confidence to introduce a new pathway for fast-track approvals through the planning system, and avoid the “cliff-edge” problem that exists.

# 4. A PROPOSED HIERARCHICAL FRAMEWORK FOR ACOUSTIC ASSESSMENT

To overcome the rigidity of the current binary system, we propose a more nuanced, proportionate, hierarchical framework for the acoustic assessment of ASHP installations to provide clear pathways for approval; this framework could be adopted as industry guidance, ideally endorsed by Government, subject to development and agreement with other parties. The proposed risk-based approach is a graduated series of compliance pathways, ensuring that the level of assessment effort is proportionate to the potential acoustic risk linked with the degree of adverse impact, avoiding a significant adverse impact.

## 4.1 Principle of Proportionality and alignment with BS 4142

The fundamental principle of this framework is proportionality whilst offering the right level of protection for residential acoustic environments. For more complex or acoustically challenging sites (such as quiet or tranquil areas that require protection), more sophisticated assessment methods should be considered by an acoustic specialist to provide a more accurate evaluation of risk, without immediately defaulting to the most burdensome process (a full BS 4142 assessment). The method is intended to create a smoother gradient to the risks, unlocking a significant number of installations that are currently stalled by the planning system and thereby streamlining the process and minimising costs for consumers, installers and LPAs. This approach is not new, but draws from successful models already in use across Scotland and much of Europe, where fixed absolute thresholds and tiered assessments facilitate efficient evaluation, with no evidence of increased complaint numbers [11]. One concern is whether BS 4142 may be in conflict with the approach being suggested. However, BS 4142 says: “*Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night*”, therefore BS 4142 does not conflict with the proposed methodology. The assumption that an environment is quiet tends to the conclusion that absolute values should be used. The precautionary application of BS 4142 is therefore aligned with the principle being applied, without needing to carry out a costly survey to determine the actual background noise level.

## 4.2 The Hierarchy of Routes

A hierarchy of five assessment pathways are proposed, which could be integrated into an updated future PDR framework, or acceptable pathways to compliance for LPAs to enable them to streamline and ‘fast-track’ ASHP planning applications, illustrated in Figure 2.

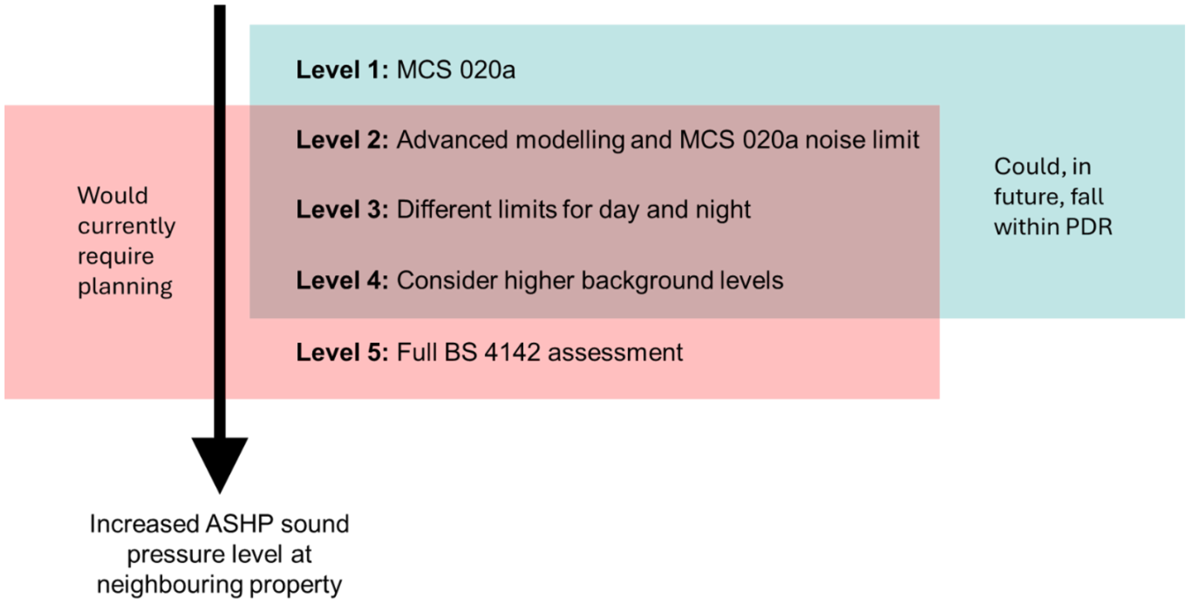


***Figure 2: Hierarchy Routes for ASHP planning permission***

## 4.3 Level 1: The Baseline (The Current MCS 020a Standard)

The starting point and simplest route remains the use of the existing MCS 020a methodology: a prescribed, simplified calculation method with a fixed absolute sound level of 37 dB(A) at the assessment position to be accepted by LPA where planning permission is required. This is appropriate for the lowest-risk installations where compliance can be easily demonstrated by a non-specialist installer at no additional cost to the homeowner, limiting the worst-case cumulative noise exposure overall to not more than the fixed sound level [13].

## 4.4 Level 2: Alternative Method to Predict to Fixed Target

For installations that marginally fail the Level 1 assessment, the next step should be to permit the use of a more accurate sound propagation model to address the inaccuracies of the simplified method. This Level 2 pathway suggests that the calculation method for sound propagation is decoupled from the impact criterion, allowing compliance with the same 37 dB(A) target at any habitable residential receptor to be demonstrated using the ISO 9613-2 sound propagation standard.

As previous research has shown, the MCS 020a calculation can be highly conservative, therefore the single change of prediction method would immediately enable a higher proportion of installations to proceed with a supporting, simplified submission of a calculation to the LPA under a full planning application. PDR could also potentially adopt this approach in future versions to standardise around a more precise calculation methodology, with a suitably qualified person providing the assessment without the need for a survey.

Applying ISO 9613-2 to ASHP assessments advocates for a fixed sound level of 37 dB(A) to be applied to domestic ASHP installations without the inclusion of any character correction for tonality, which is a departure from that previously suggested in the IOA and CIEH Professional Advice Note. This is justified by the experience of Scotland, where NR 25 is commonly used as a fixed plant noise limit internally for planning applications. The justification is that if 12 dB were allowed for the attenuation through an open window from an external sound level and applying the approximation that NR ≈ dBA - 6 the 37 dB(A) limit would equate to 37 - 12 - 6 ≈ NR19 internally, which allows a 6 dB margin in case of sound character being present (such as tonality). The spectrum shape of the sound source will determine how well the approximation from dBA to NR holds, and so there remains a prudent margin to allow for spectral shape to alter from that assumed and over-time.

### 4.5 Level 3: Differentiated Time Periods

In both the Level 1 and Level 2 pathways the assessment is essentially based on an effective night-time sound level limit applied all the time.

Drawing on established practice in Scotland and across Europe, Level 3 introduces separate, more appropriate noise limits for daytime and night-time periods. For example, a higher limit of 45 dB(A) could reasonably be applied during the daytime. This approach requires further evidence, as a garden may be affected to a greater degree than an amenity receptor location such as a balcony that forms part of the facade. The current 37 dB(A) limit would be maintained for the more sensitive night-time period, assuming that the acoustic environment is quieter at night. This approach acknowledges that a higher level of sound is likely to be acceptable during the daytime, mindful of being below older guidance on desirable ambient sound levels for new homes in amenity spaces [10]. This pathway also formally recognises the value of the "quiet mode" or night-time ‘set-back’ that is available on the vast majority of modern ASHPs, providing installers with greater flexibility to achieve compliance without unduly altering the existing acoustic environment.

### 4.6 Level 4: Site-Specific Context (Background Sound Consideration)

Where an installation is proposed in an area with a background sound level demonstrably higher than 37 dB(A), it may be proportionate to allow a higher specific sound level from the ASHP to make use of the sound masking that will result where the sound source influencing the background sound level is relatively constant (such as the sound from traffic on a major road). Level 4 would permit the rating level to be set relative to the background sound level, aligning with the principles of BS 4142 but in a simplified, established manner. The higher background sound level may be justifiable through a desktop exercise using national noise maps (DEFRA Round 4 mapping currently does not provide this data, but it may be possible to derive it or justify a technical case based on the evidence available) or, where necessary, through a site-specific environmental sound survey. This avoids restricting installations in noisier urban environments where the ASHP will be less subjectively prominent as a result.

### 4.7 Level 5: Standardised Full BS 4142 Assessment

For the most complex, sensitive, or highest-risk installations that cannot demonstrate compliance through the preceding levels, and where the LPA determines that the location may affect a designated quiet area, area prized for its tranquillity or it is a place where the acoustic environment remaining unchanged is an important part of the conservation of an area, bio net gain or its historic character, then specialist advice should be sought as part of a Level 5 assessment. In this case the final route remains a full assessment according to BS 4142. However, to reduce inconsistency and streamline the process, this could be guided by a standardised protocol agreed upon by professional bodies and endorsed by the Government Department responsible for planning (Ministry of Housing, Communities & Local Government). This protocol would provide clear guidance on how to apply BS 4142 specifically to domestic ASHPs, addressing common points of contention such as the assignment of character penalties (e.g., for tonality and intermittency) at the design stage and ensuring a consistent approach across all planning authorities. This level could also be used where the quality or appropriateness of the soundscape requires protection or safeguarding, as an example.

## 4 BUILDING THE EVIDENCE BASE: A CALL FOR RESEARCH

While the proposed hierarchical framework is a logical and proportionate response to the current regulatory shortfalls, its adoption by policymakers requires a robust and comprehensive evidence base. Currently, the proposed framework represents the expert opinion of the IOA working group, drawing on experience and evidence from numerous sources and examples of dealing with complaints. Moving from this well-reasoned proposal to an implementable national strategy that delivers the existing noise and planning policy ambition necessitates targeted research to validate its core components.

To provide this evidence, a comprehensive, multi-stage research programme has been proposed, moving beyond identifying the problem to delivering a definitive evidence base for policy change. The programme is strategically designed to provide clear, data-driven answers to modernise the current acoustic assessment standards. It integrates two critical research streams: a "bottom-up" physical validation of the sound propagation models and a "top-down" audit of real-world installations to understand on-the-ground impact and policy risk.

## 4.1 Improving and Validating the Sound Propagation Models

The first stage of the research would be to systematically validate and quantify the divergence between the sound propagation predictions in the conservative MCS-020a methodology and the more detailed ISO 9613-2 standard. This process begins with theoretical modelling in simplified, idealised scenarios to isolate and compare how each model treats the specific effects of reflecting planes, barrier attenuation, and ground absorption.

This foundational understanding is then applied to a portfolio of "problematic" real-world installation scenarios, identified in collaboration with industry partners, to quantify the difference between the models in practical contexts that are representative of the UK housing stock.

Crucially, the programme culminates in physical validation of the modelling. The most critical scenarios identified in the modelling phase will be physically replicated at suitable test sites. A purpose-built, calibrated sound source designed to mimic the size and directivity of a real ASHP will be used for testing. By comparing the physically measured sound levels against the predictions from both MCS-020a and ISO 9613, this work will provide evidence required to formally justify updating MCS 020a, and using the more accurate ISO 9613-2 model, as proposed in Level 2 of the hierarchical framework.

## 4.2 Understanding Real-World Impact

The second, equally vital, research stream addresses the broader context to ensure any policy solution is holistic and durable. It recognises that conservatism within the current propagation model may implicitly compensate for other factors, such as uncertainties in manufacturer's sound data or the absence of a penalty for tonal noise. Modifying the propagation model in isolation could inadvertently increase the risk of noise complaints.

This risk is managed through a proposed national audit of real-world ASHP installations, investigating two distinct cohorts:

- Compliance-Based Audits: Investigating sites calculated to be 'just compliant' with the MCS 020a standard to test the performance of the standard as designed.
- Complaint-Based Investigations: Conducting a 'root cause analysis' on sites that have generated noise complaints to understand why adverse impacts occur.

Developing and using a standardised investigation protocol, these case studies will compare the as-installed state with the design assumptions and assess the full acoustic character of the sound, including factors such as tonality and intermittency, which are not currently addressed by MCS 020a. By comparing findings from sites that are free of complaints and those that have generated complaints, this research provides the essential real-world evidence to evaluate the appropriateness of the current sound level limits and inform holistic improvements to the assessment framework.

# 5 FRAMEWORK FOR ASSESSING OCCUPANTS SOUND IMPACT

Currently acoustic assessment frameworks for ASHPs, such as MCS 020a, focus exclusively on the sound impact on neighbouring properties and not the acoustic impact on the occupants of the dwelling at which the units are to be installed. As a matter of social equity, given that people may be protected from noise from neighbouring ASHPs but not their own, it is important to recognise that prolonged exposure to noise can cause harm. Occupants who are not owners have less control over the siting of an ASHP where they live. We propose a simple, pragmatic framework to address the potential harm to occupants from an ASHP serving their property in a preventative way, ensuring that the benefits of low-carbon heating do not come at the cost of the residents' own acoustic amenity.

## 5.1 Extending Existing Principles of Good Design

The need to consider internal noise from heating systems is not new. For decades, good practice has dictated the careful placement of gas boilers to avoid causing disturbance in acoustically sensitive spaces such as bedrooms. The proposed framework simply extends this established principle to the external unit of an ASHP, which operates at different times and with a different sound character than a traditional boiler.

## 5.2 A Two-Tiered Approach: Guidance and Public Protection

To balance personal choice with a duty of care, we recommend a two-tiered approach to assessment:

### 5.2.1 Optional Best Practice for Homeowners

For owner-occupiers, assessing the impact on their own dwelling should be an optional step, framed as best practice. Some residents are more concerned than others about the sound impact on themselves: research indicates that 85% of occupiers with an ASHP are satisfied with the noise [14]. An installer can provide a simple calculation, using the same MCS 020a methodology, to estimate the internal sound level in the nearest bedroom, empowering the homeowner to make an informed decision about placement affecting them, or those who may be living there as tenants who do not have an opportunity to pass comment. This allows them to weigh their own comfort and that of those they have oversight of against other factors, retaining the agency to accept a higher internal sound level if the placement is otherwise ideal. As numbers of decibels rarely are meaningful for lay people, a demonstration of the sound impact in practice is likely to be the most useful information, but is more difficult to provide reliably. In cases where the landlords may be responsible for an installation, tenants who may have no say in the details may may nonetheless be impacted by placement decisions. The law of statutory nuisance [23] exists in case the impact upon them is a significant or substantial disturbance to the reasonable material use of the property. One example of this is if a social housing provider, or the Council install across their stock, and residents are impacted. Whilst this offers a potential remedy it is only likely to be helpful where sleep may be able to be evidenced as being disturbed as the bar for nuisance is high.

### 5.2.2 Mandatory Consideration for Rental Properties

In situations where a landlord, housing association, or freeholder makes the installation decision, this assessment could be a mandatory consideration. Tenants lack agency over the unit's placement and have a right to a reasonable acoustic environment. This approach protects tenants from installations that may prioritise extraneous factors (e.g. cost, ease of access) over their well-being. It also aligns with social equity aims, such as the United Nations's (UN’s) Sustainable Development Goal (SDG) 10 ‘Reduced Inequalities’.

### 5.3 Public Protection - A Simplified Assessment Method

The assessment itself need not be burdensome. It could involve the same MCS 020a calculation based on the sound level at the building façade, or proposed Level 2 or 3 methods as alternatives. It could even be a version of the Level 3 assessment with the option to further refine and differentiate between living rooms and bedrooms, with a higher limit for sound levels outside living rooms as they are unlikely to be occupied at night. An equivalent target as that in MCS 020a (37 dB(A)) outside bedrooms is likely to be desirable in quieter locations, but higher sound levels may be acceptable in environments that are not otherwise “quiet”.

This approach ensures that all residents, whether owners or tenants, are appropriately considered in the deployment of ASHPs, fostering greater public confidence and hopefully acceptance that the technology contributes positively to creating sustainable and healthy homes.

## 6 THE SOCIAL AND POLITICAL CONTEXT

An effective regulatory framework cannot be developed in a vacuum; it must acknowledge and address the wider social and political context in which the technology is being deployed. The transition to ASHPs is not merely a technical challenge but also a social one, where public perception and media narratives play a crucial role, and can create blocks to take-up by generating fear of upsetting neighbours or impeding their own quality of life as a result of introducing a new source of noise pollution, which operates in a differently temporal way from fossil fuel boilers. These non-acoustic factors can form significant barriers to adoption, and a robust, evidence-based framework is a key tool in mitigating them and creating public confidence in an area where there is legitimate concern, because of the perceived risk to health and wellbeing.

### 6.1 The Politicisation of Noise

In the UK, the sound from heat pumps has become a politicised issue because of involvement from the media. Media outlets have increasingly used noise as a political theme to oppose the decarbonisation policies of different parties in the run-up to elections and for the incumbent Government to now cast doubt on the viability of the technology and reduce public confidence in it [16, 17, 18] The potential noise pollution impact has been one such focal point, with this narrative often framing ASHPs as an inherent nuisance, creating a climate of concern, apprehension and distrust among the public. The politicisation of noise elevates the importance of a clear and defensible regulatory standard based on evidence.

When rules are ambiguous or perceived as inadequate, it creates a vacuum in which misinformation can flourish, further hindering the rollout. An evidence-based approach is therefore essential to cut through the disinformation and build back public trust and maintain political confidence in the effective delivery of a politically and globally important objective of decarbonisation.

The acoustic environment can also be described in a way which includes the non-acoustic perceptual aspects too. This is the concept of soundscape, defined as the acoustic environment as it is perceived by a person or group in context [19]. The human experience of sound is not a simple reception of acoustic energy but a complex psychological event, shaped by expectations and pre-existing beliefs. The consideration of soundscapes is therefore crucial for understanding public reaction to new technologies such as ASHPs, which may not be based only on acoustic factors.

The effect of negative narratives on ASHP noise is particularly evident in UK public search behaviour. The query "are heat pumps noisy?" is entered approximately 480 times per month by people within the UK, more than double the volume in Germany (210) and orders of magnitude higher than in France (20) or Spain (0) [20]This disparity highlights a culturally specific anxiety in the UK, likely fuelled by media coverage that pre-conditions the public to expect a negative experience.

The heightened public anxiety creates a significant non-acoustic barrier to ASHP installation. When homeowners or their neighbours hold the view that introducing a ASHP will be disruptive it triggers a well-documented psychological phenomenon known as the nocebo effect, where negative expectations manifest as genuine perceptual negative outcomes [20]. This process lowers tolerance for any sound and dramatically increases the likelihood of complaints, regardless of the objective acoustic conditions. Research on non-acoustic factors indicates that such pre-conditioning can facilitate a sense of low perceived control and sets a negative expectation, which are primary drivers of noise annoyance.

The mechanism is psychological: the socially-conditioned individual enters a state of heightened perceptual vigilance, actively listening for the expected disturbance. Their auditory system is more likely to focus on and amplify any detectable characteristics of the ASHP sound, such as tonal hums or variations in fan noise, which then become the "proof" of the expected disruption. In this way, the belief that the sound will be disruptive can become the primary cause of the disruption itself, creating a perceived adverse impact [21]. There are many anecdotal cases of adverse impact reported in the complete absence of sound emission from the ASHP, for example prior to electrical connection or when it is measured to be not operating.

### 6.2 The Role of a Robust Framework

A clear, transparent, and proportionate regulatory framework is therefore not just a technical necessity but a vital tool for building public confidence back from its current eroded and damaged place. The proposed hierarchical framework remains simple but will help to provide different pathways to triage impact against the risk and provide cost-efficient proportionate pathways through the planning system for all but the most challenging examples, which will still need professional advice.

The proposed framework will counter the narrative that ASHPs are inherently acoustically problematic by demonstrating that the right unit selected for the right location is not. This proportionate, evidence-based method for managing acoustic risk, supported and advocated by the appropriate professional bodies within the industry, has value because it provides an expert basis for additional confidence of the public. It will also use acoustics to assist in achieving the Government objective to decarbonise domestic heating of homes. By providing clear pathways to compliance based on the working groups advice, and by being underpinned by robust research, such a framework can address the nocebo effect, provide homeowners with reliable estimates of the potential noise impact of ASHPs, provide installers with more flexibility and hence less uncertainty, and provide planning authorities with a robust alternative to BS 4142. It provides a credible, authoritative counterpoint to disinformation, helping to de-politicise the issue and enabling a more objective, evidence-led conversation about the successful integration of this vital technology whilst protecting public to the extent that current national noise and planning policy expects.

## 7 CONCLUSION

To summarise the problem: the successful, large-scale deployment of Air Source Heat Pumps (ASHPs) is a non-negotiable component of the UK Government's strategy to decarbonise domestic heating in homes. However, this transition is being hindered by an outdated and inflexible regulatory framework for acoustic assessment of ASHPs through the planning system. The current binary system adds friction to the 'roll out' and restricts the noise assessment options to either a cost-effective, fast track method comprising a simple but overly conservative Permitted Development Regulation (PDR) route, or a disproportionately burdensome full planning application route. This binary pathway has created an unnecessary obstacle to ASHP installation that has stalled numerous viable installations, increased costs, and created uncertainty for homeowners and installers alike. The result is a restricted ASHP rollout held back by uncertainty over the noise pollution impact, despite Government efforts to provide reassurance. The public retains scepticism and doubt, established by media discourse and the nocebo effect. The sound level target within PDR is currently unnecessarily conservative, particularly for daytime operation, and a precautionary approach appears to be frequently taken by Local Planning Authorities that requires full and costly noise impact assessments by acoustic professionals to unlock applications in the absence of clear guidance for an alternative assessment method.

This paper has considered how acoustics can provide the key to greater ASHP rollout. The expertise and experience of the Renewable Energy Advisory Group (REAG), representing the professional body of the Institute of Acoustics, has been applied and a robust, pragmatic and proportionate solution that uses a hierarchical, risk-based framework for acoustic assessment has been proposed. The proposed framework is based on establishing four additional pathways to noise assessment compliance, beyond the one currently available under PDR. Three of the pathways suggest a method to demonstrate compliance with current planning and noise national policy as an alternative to a full BS 4142 assessment. The proposed framework offers a tiered approach, from simple calculations to more detailed models, and consideration of time of day, and the existing environment. This replaces the current "all-or-nothing" system, creating a smoother, more logical, and cost-effective path for gaining planning approval. The proposed framework also ensures that the assessment efforts are always aligned with the level of acoustic risk that exists, thereby streamlining the approval process for the vast majority of low- and medium-risk installations and releasing the obstruction to the majority of the installations that are intended for the rollout of ASHPs in the UK. The safety net remains in place as Level 4 in which specialist advice from a suitably qualified acoustician should be sought.

The triage process suggested will enable the acoustics profession to empower the public, installers and LPAs with the confidence to make the transition to low carbon heat that is needed as part of meeting Government carbon net zero aspirations in the UK, but because sustainability encompasses more than just decarbonisation there is a wider consideration too. The intervention would also deliver more broadly on the social aspects of the United Nations's (UN’s) Sustainable Development Goal (SDG), including goals 3 (good health and well-being),10 (reduced inequalities),11 (sustainable cities and communities) and 16 (peace, justice and strong institutions), ensuring it is both a robust and effective approach and that it is also part of an efficient, equitable, and acoustically sustainable approach to delivering the vision for decarbonisation in the UK.

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