



## Heat Strategy for Wales

### Consultation response from Nesta Cymru

Nesta is the UK's innovation agency for social good. We design, test and scale new solutions to society's biggest problems, changing millions of lives for the better. The aim of Nesta's **sustainable future** mission is to help rapidly accelerate the reduction of household emissions by 2030 and to ensure that policies and conditions are in place to support continued reduction from 2030 onwards.

Our work is entirely focussed on reducing emissions from homes. So any comments in this response should be assumed to be solely in reference to domestic heating rather than industrial, commercial or public buildings.

This response was prepared by:

Andy Regan - Mission Manager, a sustainable future

Roisin Gorman - Data Scientist, a sustainable future

#### Contact

If you have any questions regarding this submission please contact Andy Regan [andy.regan@nesta.org.uk](mailto:andy.regan@nesta.org.uk)

## Section 2: A vision for heat in Wales

### Q1. Vision: Do you agree with our vision? (Yes/No) Please suggest amendments if you think it could be stronger.

Nesta largely agrees with the vision. We particularly welcome the clear statement that the Welsh Government expects most homes to be served by heat pumps. We feel this clarity is important for two reasons:

- 1) This better enables the development of focussed policy from the Welsh Government around its role in accelerating heat pump roll out. This is a particular area of focus for Nesta's sustainable future mission and we are keen to contribute to this goal in Wales
- 2) Clarity from governments about the direction of travel on the best replacement for fossil fuel heating systems potentially sends a clear signal to consumers, helping build confidence that heat pumps are the right option for their home. It should also give clarity to tradespeople and businesses about the direction of travel which can inform their long-term planning.

#### Heat pump targets

The Welsh Government's previous consultation on new renewable energy targets included a proposed 5.5GW target for installed heat pump capacity (around 3.3GW of which we assumed would come from homes).

We are re-submitting [our response to this consultation](#) as an appendix to this document, and would ask that Welsh Government consider it as part of our overall response to the Heat Strategy.

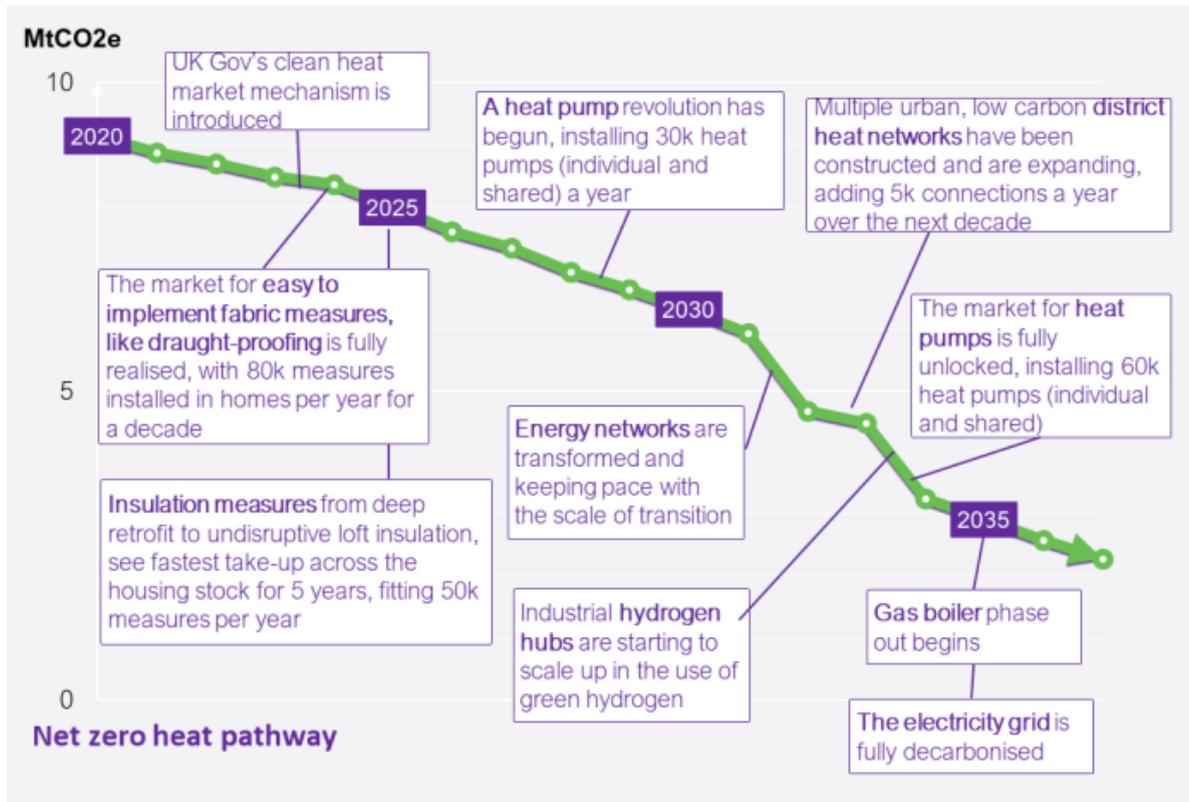
In summary, Nesta welcomed the ambition of the proposed target, but argued that a target based on the number of homes with a heat pump system would be more effective and clearer to plan for.

We also proposed that Welsh Government adopt a target of 400,000 homes by 2035, arguing this would be both ambitious and achievable through a

combination of new and existing policy. This would put Wales broadly in line with the Climate Change Committee's (CCC's) balanced pathway.

The Heat Strategy does not explicitly state a revised heat pump target, but one can be inferred from Figure 32 on page 68 (reproduced below), where the 'heat pump revolution' delivers 30,000 heat pumps per year by 2028 (rather than homes served by heat pumps). If we crudely assume this averages out to 30,000 each year from 2024 to 2035, this would deliver 330,000 heat pumps in the timeframe. This is slightly lower than Nesta's proposed 400k target and therefore somewhat less ambitious than the CCC's pathway. We also previously suggested that any target for heat pumps should be expressed in terms of numbers of homes served, rather than heat pumps installed. This is a better approach to, for example, counting shared ground source loops serving multiple homes within any target.

However we haven't attempted here to model any ramp up to this annual figure, or made any assumptions about how the annual figure might continue to increase. We assume the rate of heat pump uptake in Wales would more likely be exponential in the long term rather than linear once the market matures.



**Figure 32:** Emissions pathway for heat in Wales up to 2035 with milestones

### Current heat pump adoption in Wales

Below we update our snapshot of heat pump take-up in Wales. The figures and numbers below are derived from MCS-certified heat pump installation data combined with additional ONS and Xoserve datasets. There have been around 9700 MCS-certified heat pumps installed in homes in Wales as of 30 June 2023 (Fig. 2). Please note, the charts do not display years before 2015 due to previous years exhibiting low numbers of installations, but all installations up to 30 June 2023, including pre-2015, are included in the cumulative counts and charts. For comparison: almost 11,000 of the 940,749 properties in the Welsh EPC database are recorded as having a heat pump installed as of 31 July 2023.

Not every heat pump installed in homes in Wales is captured within the data, as not every installation historically will have been MCS-certified. This is particularly true of new-builds. Subsidies provided by the Renewable Heat Incentive and Boiler Upgrade Scheme require MCS accredited installation,

and we would assume that the majority of retrofit installations have benefited from this funding.

### Cumulative MCS certified heat pump installations over time

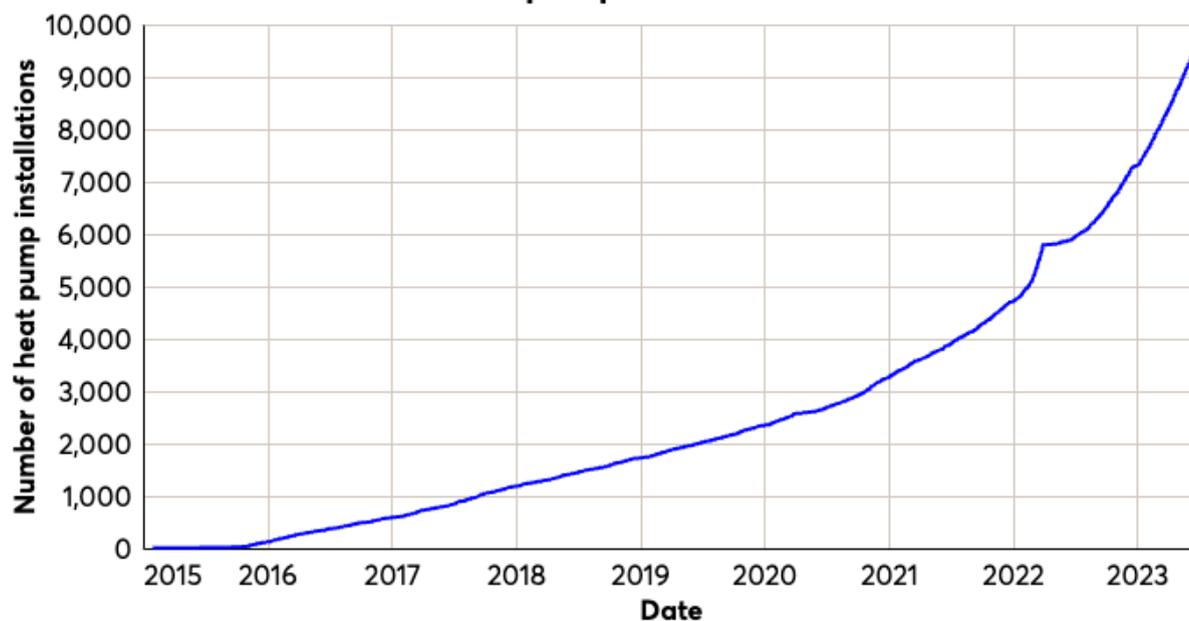


Fig. 2. Cumulative MCS-certified heat pump installations in homes in Wales from Jan 2015 to end of June 2023. Cumulative count includes pre-2015 data.

Fig. 2 shows there appears to be a welcome increase in the rate of adoption over the last five years with around 600 MCS-certified heat pumps being installed per year in Wales from 2016 through to 2021, and then an increase to an average of around 2,000 per year in 2021-22 and 2022-23, with almost 2,400 installations up to the end of June 2023.

Fig. 4, below, indicates that MCS-certified heat pump installations are higher in rural areas, with only 11% of installations being in urban areas. Uptake is also higher in off-gas areas, than areas with a mains gas connection (Fig. 3).

Nesta's previous work modelling heat pump uptake in Scotland indicated a broadly similar pattern. Uptake in Scotland was higher amongst people replacing oil boilers, and for off-gas properties clearly a combi-boiler is not an option. We have not run a similar analysis for Wales at this time, but we believe the same conclusions could realistically apply.

ONS dwellings and rurality datasets indicate that one third of Wales' homes are in rural areas and combining Xoserve and postcode directory data shows that around 20% of Welsh postcodes are off-gas. With this, it is clear that the rate of uptake in urban / on-gas areas will need to be a focus - and may well need a distinct approach.

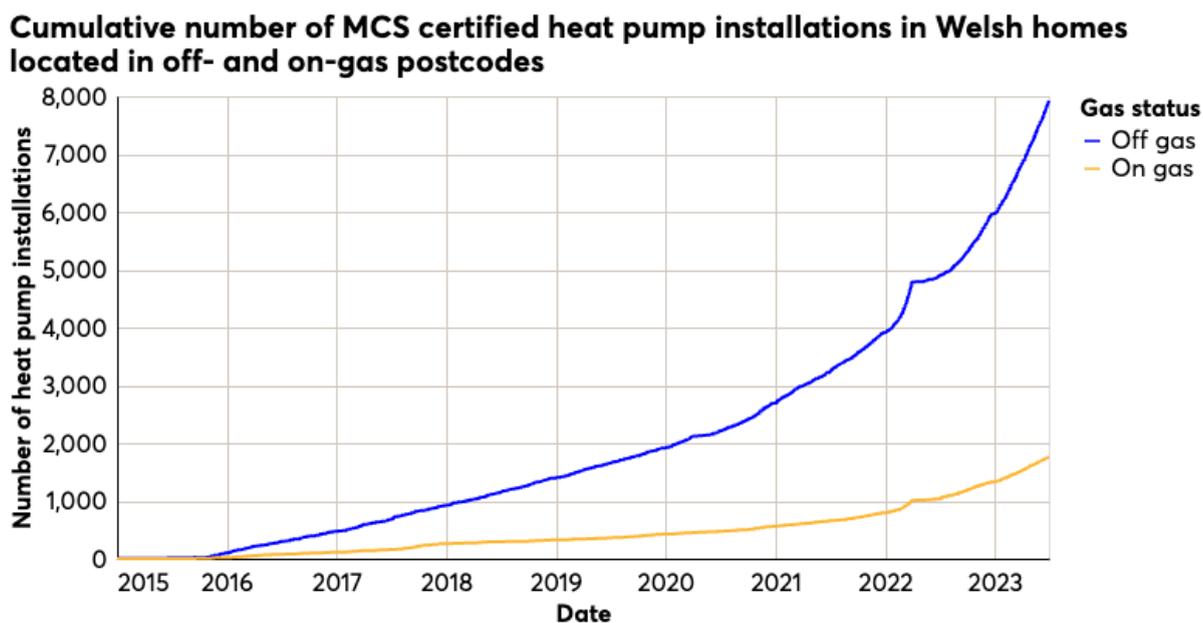


Fig. 3. Cumulative number of MCS-certified heat pump installations in Welsh homes located in off- versus on-gas postcodes from Jan 2015 to end of June 2023. Cumulative counts include pre-2015 data.

### Cumulative number of MCS certified heat pump installations in Welsh homes located in rural vs urban postcodes

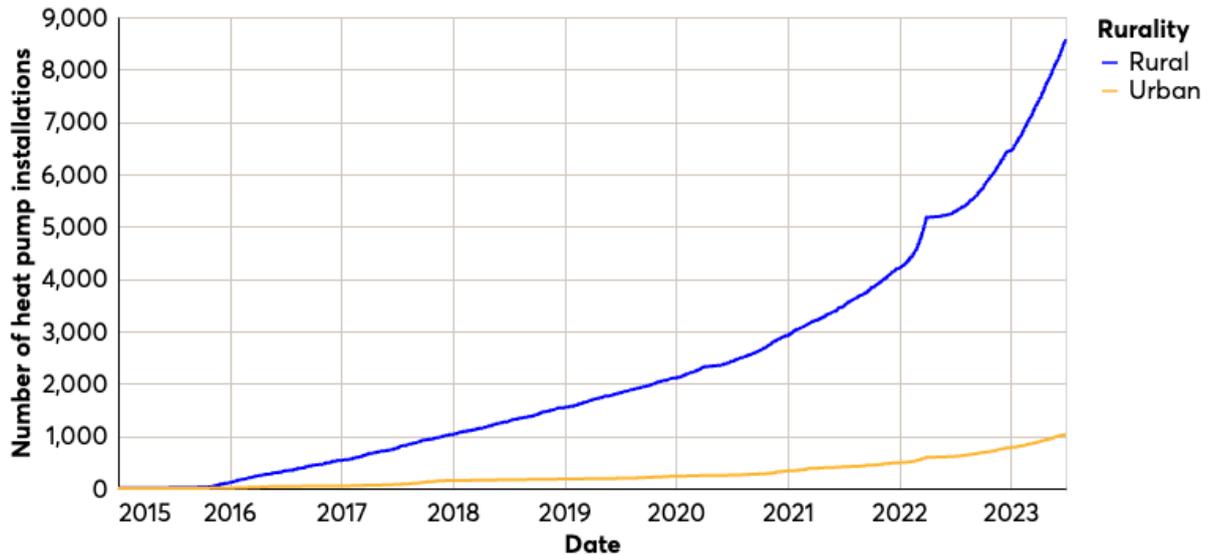


Fig. 4. Cumulative number of MCS-certified heat pump installations in Welsh homes located in rural versus urban postcodes from Jan 2015 to end of June 2023. Cumulative counts include pre-2015 data.

**Q2. Objectives: The Heat Strategy for Wales policies are broken down into 17 objectives within six groups. Do you agree they adequately cover the areas where Welsh Government needs to focus? (Yes/No) If you think there are any areas missing, please explain what they are.**

Nesta's sustainable future work is entirely focussed on reducing emissions from homes. So any comments in this response should be assumed to be solely in reference to domestic heating rather than industrial, commercial or public buildings.

We therefore limit our comments to objectives A to J in the first three groups (enabling frameworks, networks, and homes). We largely agree with the vision as set out.

However, we believe objective I may require further consideration.

**Objective I:** *Homes are thermally-efficient and served in the main by heat pumps – a whole building approach has been taken to the transition and homeowners understand how to operate their systems*

There are three key elements:

1. The need to identify segments of the housing stock where policy could focus initially to lay the groundwork for faster uptake over the lifetime of the strategy, and recognising the trade offs between accelerating uptake of heat switching and slower and more costly 'whole house' approaches.
2. The limits of government's ability to mandate any given approach in private homes, whether on heat or fabric. Consent will be a key principle in the heat transition. Homeowners have a right to choose a combination of upgrades which may be suboptimal from an energy-efficiency perspective, but which meets their wider aspirations for their home.
3. Going beyond understanding how to operate heating systems as the main barrier to both increased uptake and positive experiences of using heat pumps.

## **A targeted approach to heat pump adoption**

In our response to the consultation on updated renewable energy targets (including heat pumps), Nesta recommended Welsh Government should **make the installation of heat pumps in 'heat pump-ready' existing homes a focus for the forthcoming Heat Strategy.**

We feel the strategy could be improved by further consideration of this recommendation, and that Welsh Government should identify where the opportunities are to drive adoption earlier in the crucial 2023-2028 period (with 2028 being the current planned timeline for the end of the Boiler Upgrade Scheme).

We believe there is a policy opportunity in Wales for a targeted approach to increasing heat pump adoption in 'heat pump-ready' homes - particularly in the private housing market. This should be a focus for the Heat Strategy.

We have argued that the purpose of an ambitious but achievable heat pump target should be to drive and support the design of effective policy to reduce the barriers to widespread take up. There comes a point at which increased adoption of heat pumps in itself starts to play a role in breaking down the cost and appeal barriers - whether through economies of scale, or increased familiarity with the technology.

We recognise that there is not a universally accepted definition of 'heat pump-ready'. The Welsh Government should work towards adopting a definition of what this would mean. Broadly, heat pump-ready should mean 'a home which can successfully be heated with low temperature heating without substantial additional upgrades to its fabric or heating distribution system' (acknowledging that 'successfully' and 'substantial' would themselves need to be defined).

A 'perfectly' heat pump ready home would be one which could have a heat pump with no additional retrofit work whatsoever. However, we believe that a more pragmatic definition, rooted in low to no additional retrofit being needed, would successfully drive supporting policy and achieve decarbonisation at pace.

The Welsh Government should look at homes in Wales in terms of those characteristics which **contribute positively to heat pump readiness**, rather than a risk averse approach which emphasises deficits in readiness.

We should also not conceive of 'heat pump-ready' as being a simple binary, or indeed an absolute condition. Readiness will also be partly about the interaction between the physical characteristics of the property and homeowners' willingness to pay and act.

Physical characteristics most likely to contribute to heat pump readiness would be:

- fabric energy efficiency
- current heating system - particularly homes that are off gas or already on electric heating.

## **How many Welsh homes could be 'heat pump-ready' today?**

Heating system design is complex and homes need individual assessments before green upgrades are made, as well as verification and testing after installation to ensure the new system is working optimally. Any attempt to define 'heat pump-ready' should be as an aid to policy targeting, and to shift the message for consumers from one which we fear harms net zero ambitions ('not all homes can have a heat pump') to one which is more nuanced, evidence-based and ultimately more likely to prompt action.

We should avoid creating the impression in householders' minds that deep and extensive fabric retrofits will be necessary to decarbonise all homes. Some homes will not need any fabric retrofit at all - and the Welsh Government should prioritise these for heat pump installation in the short term to deliver its target.

With this in mind, we believe that between a quarter and a third of Welsh homes might be ready to have a heat pump installed without any upfront fabric retrofit.

Our assumptions here are:

- There are over 299,000 Welsh properties in the EPC databases<sup>1</sup> that are EPC C and above, and which also have 'good' or 'very good' wall insulation (31.8% of all records).
- Of these, around 218,800 also have 'good' or 'very good' roof insulation (23.3% of all records).
- These properties are likely to be able to be heated effectively with a low-temperature heating system. In practice, some may need

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<sup>1</sup> Noting that not all properties are in the EPC database

upgrades to pipes and/or emitters (radiators), but further reducing heat loss through insulation is unlikely to be cost effective over the lifetime of a heat pump.

Cambridge Architectural Research undertook modelling<sup>2</sup> for Nesta around flow temperatures. They estimated that 72% of homes have radiators suitable for flow temperatures of 60°C and 53% for 55°C (on a mean winter's day). Of these, roughly 92% would also have suitable pipework for a 55°C flow temperature.

A provisional estimate, which would require further work, would be that we might assume that around half of well-insulated homes are also likely to need only minor upgrades to radiators.

We note that our above assumptions take a more conservative approach to defining 'heat pump-ready' than the UK National Infrastructure Commission in its [National Infrastructure Assessment](#) which concludes that EPC D rated homes could be considered heat pump-ready.

## **Fabric and heat pump readiness**

The fabric efficiency of buildings plays a role in how easily they can accommodate a heat pump as a retrofit without substantial additional changes.

A heat pump needs to be able to produce enough heat to replace heat lost. Therefore the fact that heat pumps run at lower flow temperatures is relevant here, as a lower mean water temperature means lower output for the same radiators. Heat pump readiness will therefore mean understanding how well the home can accommodate low-temperature heating. Again, this will at least partly depend on what homeowners choose to prioritise.

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<sup>2</sup> Free and low-cost energy-saving actions to bring down bills, improve energy security and help the planet (2022)  
<https://www.nesta.org.uk/report/free-and-low-cost-energy-saving-actions-to-bring-down-bills-improve-energy-security-and-help-the-planet/>

Total heat demand impacts the size of heat pump needed (as discussed above), so there might be an absolute constraint if heat demand is too high overall - eg, some of the largest homes might need two heat pump units.

However, in a majority of cases it would be incorrect to state that a heat pump 'cannot' work in a home. Rather this will be a trade off between upfront costs (insulation, replacement radiators etc.) with long term running costs.

For some homes, the amount of additional fabric insulation needed to ensure a heat pump system works well is likely to be minimal. In other cases, the same results could be achieved by resizing radiators. Effective heating controls, which householders know how to use, can also mitigate the need for either insulation or replacement radiators. In some cases, a larger heat pump or a system designed to run at a slightly higher flow temperature will be more cost-effective than a smaller heat pump plus more extensive fabric measures.

In weighing up any of these options, we should also be cautious of overestimating the appetite homeowners or landlords will have for the disruption and cost of multiple rounds of building work. If we want people to act, then the message that they absolutely need to have both fabric insulation and a heat pump may result in some homeowners not doing either.

The Energy Systems Catapult's Electrification of Heat Demonstration Project<sup>3</sup> on behalf of DESNZ is evidence that heat pumps can be successfully installed in any housing archetype. The ESC noted that "energy efficiency upgrades were only made for 15% of properties where a heat pump was installed – in most cases this was loft insulation. The majority of homes where a heat pump was installed had an Energy Performance Certificate rating of C or D." 11

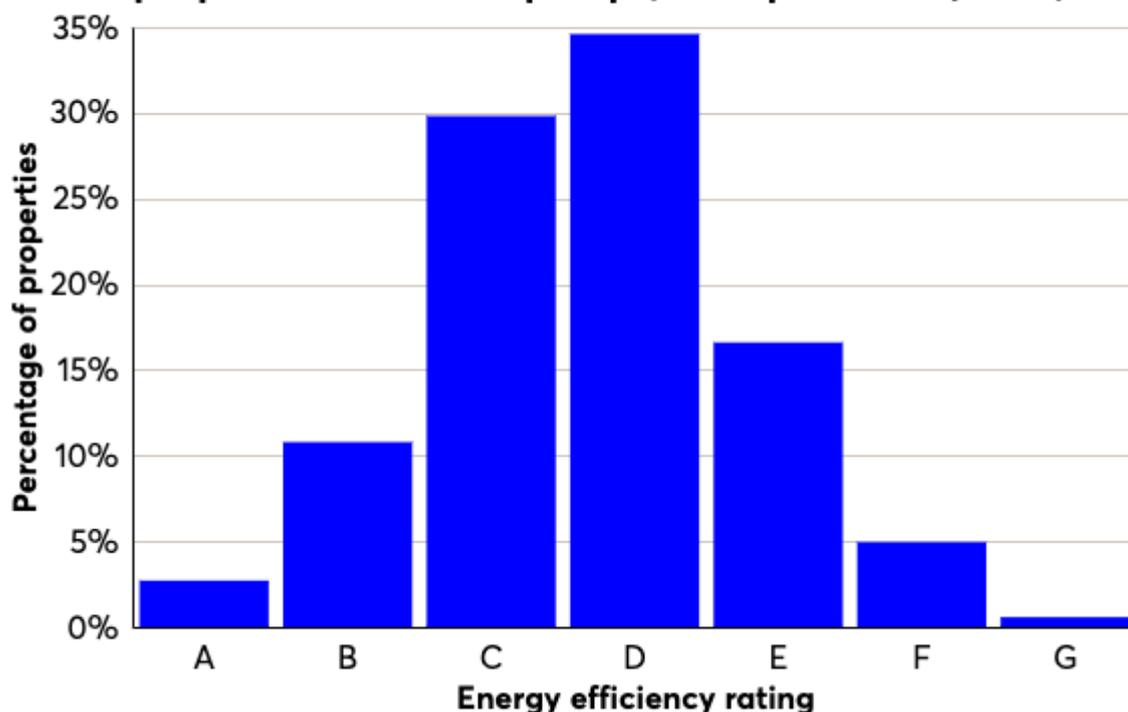
Nesta's most recent snapshot of EPC data from July 2023 shows a similar picture. Most heat pumps in Wales are going into EPC C or D rated homes,

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<sup>3</sup> Energy Systems Catapult Electrification of Heat Demonstrator project  
<https://es.catapult.org.uk/news/mass-rollout-of-heat-pumps-feasible-but-innovation-needed/>

broadly in line with the UK National Infrastructure Commission's proposed threshold for heat pump readiness.

### **EPC ratings of owner-occupied and privately rented Welsh properties with heat pumps, built pre-2007 (N = 3,700)**



Sero homes have undertaken analysis<sup>4</sup> of what level of fabric retrofit might be needed to accommodate a heat pump, concluding that:

“Modelling of the UK suggests that the ‘cost optimal’ balance from the system perspective is to reduce heat demand by about 10%. This amounts to a pretty ‘light’ fabric retrofit, such as cavity wall insulation, loft insulation and some window upgrades. This differs from other countries because of the UK’s large wind resource, which coincides well with seasonal heat demand.”<sup>12</sup>

<sup>4</sup> 12 Sero: Retrofit: is Fabric First Really the Best Strategy?  
<https://sero.life/energy-advice-support/understanding-energy/retrofit-is-fabric-first-really-the-best-strategy/>  
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## Section 3: Our enabling framework

### **Q3. Planning: Our Strategy identifies that the current permitted development rights related to heat pumps are a barrier to heat pump installation rollout. Do you agree? (Yes/No) Please explain.**

Yes, we agree. Nesta has previously responded to the Welsh Government's consultation on the Noise and Soundscape Plan for Wales 2023 to 2028. Our comments on how to address concerns about noise from heat pumps are reproduced in full below.

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We agree with the following key points made in Section 5.2 of the [Noise and Soundscape Plan for Wales 2023-2028](#):

- Wales needs alternatives to gas and oil boilers to reduce carbon emissions.
- It will need to see a significant rise in heat pumps to meet its net zero ambitions.
- Air source heat pump (ASHP) uptake is currently limited as they must be installed at least 3m from domestic property boundaries to be permitted developments - this means Welsh householders potentially face higher barriers to getting a heat pump than those in England and Scotland, where the limit is 1m.
- Permitted development rights and MCS should be improved to enable ASHP uptake.

We have conducted some research to discover how best to improve the current situation. This has involved interviewing and running workshops with key stakeholders including home owners, heating engineers, local authorities, officials in the UK government, MCS and acousticians. We plan to respond to the upcoming UK government and MCS consultations.

At this stage we would like to share the following three findings to aid your deliberations:

1. The current approach restricts uptake of heat pumps, fails to manage the risks effectively and unfairly penalises Welsh homeowners.

Homeowners are often put off heat pumps by the cost, delay and risk of planning. Planning applications can cost thousands of pounds and add months to work. Sensible planning applications can be rejected for idiosyncratic reasons (e.g. a council official unilaterally imposing stricter noise limits than specified in the MCS). Installers focus instead on customers who do not need planning permission, to save time.

Restricting permitted developments to relatively small ASHPs fails to minimise the risk of noise. This is because larger ASHPs can be designed to be quieter than smaller ones as there is more room for sound insulation and a larger, slower fan.

ASHP installers told Nesta that they save time and money by focusing more effort on customers who do not need to apply for planning permission. This means that the 3m rule could make it harder for Welsh homeowners to install ASHPs than their neighbours in England where the limitation is smaller, at 1m.

2. Change the rules so they focus on managing the risk that noise becomes a nuisance.

The main concern is that ASHPs make a sound that causes a noise nuisance. Consider removing restrictions on the ASHP size and where they can be installed and focusing instead on making sure they do not cause this noise nuisance.

Clearly, people cannot be disturbed by noises they cannot hear. Furthermore, human sound detection thresholds are higher in noisier environments. In plain English, it is harder for people to hear a whisper

at a rock concert than a library. Therefore it would be sensible to set sound limits based on how noisy areas already are.

Ambient noise levels vary hugely as a function of time and space. It is generally quieter in the middle of the night than during the day and quieter in remote rural areas than in dense inner cities. So, it might make sense to let noise limits vary with place and time, if the goal was to manage the risk of noise.

In addition, ASHPs will make more noise at some times than others. They are likely to make most noise on the coldest winter evenings, when people are inside with the windows closed. Conversely they will make less noise during hot summer spells when people are more likely to spend time outside and leave their windows open.

3. Encourage UK government to give MCS responsibility for managing heat pump noise

Best practice installing ASHPs in the UK will evolve over time for various reasons (eg, experience, new technologies, improved understanding of soundscapes). So, it makes sense to update the rules as understanding improves.

It takes longer to update planning laws than the MCS rules. Therefore it would make sense to continuously update MCS rules based on best practice in noise nuisance prevention and allow ASHPs to be installed under permitted development as long as they comply with MCS.

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Nesta is continuing to develop and refine our proposals above, working with DESNZ and the Scottish Government with a view to reducing barriers which ideally also results in a more consistent approach across UK nations. A consistent approach will lower costs for consumers as installers won't need to invest in learning how it works multiple times.

We would welcome the opportunity to support the development of Welsh Government policy on heat pumps and planning.

**Q4. Planning: Each local authority in Wales is producing a local area energy plan (LAEP). This strategy proposes the LAEPs should be used to help deliver place-based heat decarbonisation. Do you agree with this approach? (Yes/No) Please provide evidence, where relevant.**

Yes. We broadly agree with the principle of local energy planning. We believe it has the potential to support:

- better coordination of heat electrification (along with transport and industry) with electricity grid upgrades
- better embedding of local energy infrastructure in the local planning system
- identifying areas which would be suitable for more collective approaches to heat (such as heat networks, or shared ground source heat pump loops)
- long-term planning for the decommissioning of the gas grid.

Nesta's own thinking on how exactly local planning might best work is still in development. We are currently thinking about the heat transition in terms of three phases.

- Phase 1: focus on maximising growth of low-carbon heating (present - 2035)
- Phase 2: focus on avoiding electricity grid bottlenecks and reaching harder-to-decarbonise areas (2035 - early 2040s)
- Phase 3: focus on an orderly and fair phase out of gas (early 2040s onwards)

We think it will be important to consider the optimal size and composition of institutions to deliver this. We are interested in whether partnerships between

distribution network operators (DNOs) and local authorities might bring the right combination of capabilities to bear on the issue. It may be, however, that a direct role for all 22 Welsh local authorities may not be the optimal level for such a collaboration – especially given the current short-term financial outlook for local authorities and the urgency of the task.

Corporate Joint Committees (CJCs) may be a better level for this responsibility to sit, given the larger geographical areas they cover. However we recognise that the two electricity distribution regions in Wales do not precisely map on to CJC boundaries.

**Q5. Understanding and engagement: Does the strategy suitably address the advice needed to install low carbon heat? (Yes/No) Please explain which groups should be involved in raising awareness and providing advice.**

As the draft strategy notes, Nesta's previous work in partnership with the Development Bank of Wales concluded that clear consumer advice was essential to give homeowners the confidence and ability to make investment decisions in green home upgrades<sup>5</sup>. So we welcome this being an identified objective.

However, the strategy only partly addresses this need. More detail is needed on how the best advice landscape will be achieved, and a more holistic view of how householders receive information and advice which influences their decisions.

Our response below focuses on policy 28:

“We will support homeowners with advice and support for the transition to low carbon heat – we'll share resources and opportunities such as the Boiler Upgrade Scheme grant, and share a customer journey for

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<sup>5</sup>Nesta 'All The Things I Could Do' 2023

<https://www.nesta.org.uk/report/all-the-things-i-could-do-financing-green-home-upgrades/>

how to implement and operate a heat pump system supported by fabric improvement.”

Key considerations for the success of this policy would be ensuring there are advice and support interventions which address each of the factors below.

### **Upfront cost**

The strategy largely covers the key dependencies for this in terms of subsidies and finance, via signposting to the Boiler Upgrade Scheme and the Development Bank of Wales’ financial product as and when it becomes available.

### **Lifetime and running costs**

Householders will benefit from advice about how electricity-to-gas price ratios are likely to affect them in the medium to long-term. This should mean advice materials and services should be able to respond reasonably dynamically to potential changes in UK policy, for example around policy levies on bills and market reform.

More detail on why these changes would benefit homeowners is set out in Nesta’s Policy Plan For Decarbonising Homes<sup>6</sup>.

### **Heat pump controls and performance monitoring**

The strategy rightly identifies confidence in using low-carbon heating systems as an advice need. Homeowners should also be aware that overall performance and efficiency of their system will affect their experience and running costs.

Nesta is advocating<sup>7</sup> that the UK Government should consider mandating open monitoring of heat pump performance using a standardised approach and that this information is made available to the householder. This should help ensure householders benefit from the advertised efficiency of their heat pump unit.

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<sup>6</sup>Nesta ‘A Policy Plan for Decarbonising Homes; (2023)  
<https://www.nesta.org.uk/report/a-policy-plan-for-decarbonising-home-heating/>

<sup>7</sup> Ibid

## **Appeal**

As well as costs, Nesta's work focuses on what we broadly term the 'appeal' of heat pumps, which covers a number of matters.

There is a clear need for simple, accessible information. Nesta is [developing an online service](#) that provides clear, compelling information for potential heat pump adopters, enabling them to take concrete steps towards installation. This project draws on design thinking, digital product development and behavioural insights methods to design, test and launch a consumer-facing beta service that helps potential heat pump adopters access the information they need to move forward with their installation.

Heat pumps are also an unfamiliar technology for most householders. Many people have never seen one, or been in a home heated by one. Innovative approaches which are not purely information-based have the potential to bridge this gap.

Nesta is piloting a service called [Visit a Heat Pump](#). This facilitates visits by interested householders to homes where a heat pump is already installed, giving them some first hand experience and an opportunity to speak to existing owners.

Our aspiration is that this first-hand experience will positively influence their purchasing decisions, given the generally very positive experience of heat pumps identified by our [heat pump user survey](#). The service is now available to households in Wales. In the longer-term it could be made available as a platform which local authorities, social landlords and others who play a trusted advisory role in their local area could use to engage householders or tenants in the transition.

Our [research](#) with the Development Bank Of Wales suggested homeowners also perceived a risk of choosing a low-carbon heating system which could turn out to be 'wrong'. Wrong could either mean for their specific home, or

because a different technology later emerged as the dominant one (with hydrogen boilers being the most mentioned example).

However, the research encouragingly also suggested a level of trust in 'the government' (in a general sense). When discussing government-backed finance products, interviewees assumed that the government would 'do its homework'. By this they meant ensuring the measures on offer were suitable and that work would be backed by some sort of guarantee. Therefore, given the strategy articulates only a limited role for hydrogen in heating, the Welsh Government should also ensure that advice reflects and amplifies this decision.

### **Informal advice**

It is important to not only conceive of advice in terms of a product or service, but in terms of informal networks. Work by Nesta and others has identified gas engineers as a trusted source of advice by homeowners.

The Social Market Foundation found [a range of views](#) amongst home heat installers on the suitability of heat pumps, with a trend to believe they are either more suitable, or only suitable for new-build or highly insulated homes (this is a view Nesta would contest).

Nesta's own [engagement with gas engineers](#) in 2021 suggested they recognised their own influence over customers' decisions, but sometimes felt uncertain about the right advice to give, or were sceptical about the suitability of heat pumps. However, in most cases, those who were sceptical had little direct experience of heat pumps.

Our [heat pump user survey](#) found that over two-thirds (70%) of respondents discussed their installation with heat pump manufacturers or installers, with 45% using 'government websites'.

Gas engineers are trusted and widely consulted, but are potentially providing inaccurate or incomplete information when asked. Policies which engage installers positively with information about heat pumps are therefore likely to

be an important complement to direct consumer advice. The ideal scenario would be to convert gas installers into advocates for the technology.

### **Customer journey**

We would be interested to understand in more detail what Welsh Government intends when it says it will 'share a customer journey'. There is unlikely to be a single customer journey from a fossil fuel system to a heat pump system, though clearly there will be overlapping needs across a range of housing archetypes and household demographics.

### **Q7. Skills: Do you agree that Welsh Government has a role in understanding and subsequently supporting the development of the necessary skills for heat decarbonisation? (Yes/No)**

**Please highlight any emerging skills/roles which we should support.**

Yes. Nesta is aware of the Welsh Government's separate consultation on net zero skills and will be preparing a response to this in due course.

A paramount consideration will be the extent to which clear demand for skills around heat pump installation is vital for the confidence of existing tradespeople making a decision to change careers, or for young people leaving education to choose this as a career. Clarity from government is an important component of this.

**Q8. Costs: Do you agree with the position set out in the strategy that the UK Government should move environmental levies from electricity bills to general taxation? (Yes/No)**

**What additional policies should be implemented to ensure a fairer distribution of costs?**

We agree that environmental levies should be removed from electricity bills. However we do not have a fixed view on whether those levies should then be moved into general taxation.

The key factor affecting the running costs of heat pumps (and all clean electric heating) is the ratio of electricity-to-gas prices. Heat pumps typically use three to four times less energy than a boiler (depending on how efficient the heat pump is), but electricity has typically been three to five times more expensive per unit than gas. The high relative price of electricity in effect cancels out the efficiency bonus brought by heat pumps.

The UK has one of the highest electricity-to-gas price ratios in Europe over the last decade. The UK's ratio has typically been around or above 4 in recent years, while in France, for example, the ratio is currently around 1:7. Countries with cheaper electricity relative to gas generally have higher rates of heat pump uptake. For the UK to adopt heat pumps en masse – and significantly reduce energy bills – making electricity much cheaper relative to gas is crucial. Nesta's research shows that if lower running costs and affordable finance is in place, up to 38% of homeowners would choose a heat pump to replace a gas boiler even at this early stage in their development. This would be equivalent to almost 400,000 heat pump installations per year – around ten times the current rate.

The first key policy to achieve this is for the UK government to permanently remove the environmental and social levies that are currently added to electricity. This would reduce heat pump running costs by £110 a year for a typical home.

To give more confidence to the low-carbon heating market, and increase the incentives to reform the electricity market, the UK government should set a cap on the electricity-to-gas price ratio. Ideally this cap would reach 2.5 (electricity costing 2.5 times more per unit than gas), although the cap may need to start higher and gradually move to this level. This cap could be maintained either through taxes on gas, subsidies for electricity or by moving towards improving and greening the electricity market.

The broad options (which can be combined as needed) for achieving a cap on the electricity-to-gas price ratio are:

- taxing the price of gas, to make it more expensive relative to electricity
- subsidising the price of electricity, to make it cheaper
- changing the electricity market to make cheaper forms of electricity, such as renewables, set the market price rather than gas.

The long-term aim should be for the electricity market to deliver cheaper, greener power. Setting a price cap which requires taxes or subsidies may provide an incentive for the UK government to accelerate progress towards electricity market reform.

## **Section 4: Transforming our networks**

**Q9. Electricity networks: Do you agree that upgrading Welsh electricity networks for net zero will require clear leadership and plans from Welsh Government and local authorities? (Yes/No) Please explain your reasoning and highlight any further roles for Welsh Government on this challenge.**

Yes, as above we believe the principle of local area energy planning is the correct approach, and LAEPs can provide a good forum for this.

Local authorities working in partnership with distribution network operators or the future system operator can support better long-term planning by contributing to more accurate estimates on increasing demand for electric heat long-term. However, as noted above the capabilities and resourcing needed may mean that a larger decision-making unit is more appropriate. This may mean corporate joint committees are the most appropriate level for this collaboration - though this would warrant further analysis.

**Q10. Heat network zoning: Do you agree that local area energy plans (LAEPs), led by local authorities, is an appropriate method for identifying areas for heat networks? (Yes/No) Please explain.**

Yes, as above. Nesta has not yet undertaken detailed work into how LAEPs could best achieve this.

Importantly, we believe that maintaining public consent will be an essential component of local area planning. There will need to be careful consideration of the respective roles of incentives, support, formal guidance, standards and regulation, and ultimately mandation at different phases of the transition to net zero by 2050.

We are exploring the potential of a number of different models for how local approaches to heat (including air and ground source heat pumps as well as heat networks) could be delivered. We do not yet have a view on which approach is optimal and well, but we believe there are five potential approaches to collective / local approaches to domestic heat upgrade which are summarised briefly below.

**Market-led (status quo)**

- Private companies contact people in a street and try to sign them up to communal heating.
- Local authorities can support this at their discretion.

### **Local commissioning**

- A local body is in charge of commissioning voluntary street-by-street transitions.
- They contract this out to private companies who try to sign people up.

### **Regional approach**

- Local bodies commission voluntary street-by-street transitions (possibly including the DNO in delivery).
- Heat sources are part of heat-as-a-service contracts, and potentially owned by DNOs/delivery bodies.

### **DNO-led approach**

- DNOs are made responsible for rolling out low-carbon heating.
- They operate a rolling programme of street-by-street transitions that are voluntary but provided on a monopoly basis.

### **Planned approach**

- Local or national government designates some / all neighbourhoods for a particular type of low-carbon heating.
- They commission contractors to deliver compulsory switches in those areas.

We appreciate that some aspects of the above approach are not within the scope of Welsh Government's competence to implement.

## **Q11. Heat network connections: Do you agree that new housing developments and large commercial buildings should be required to connect to new district heat networks? (Yes/No)**

There are two potential interpretations of this question which affect how we would answer.

The draft Heat Strategy reads "the powers to oblige connections to suitable low carbon heat networks can be an enabler for future low carbon heat – in particular for new builds." We would interpret this as meaning that 'where a

suitable existing heat network is available, new-builds should be required to connect to it'. We would broadly support exploring this approach, as it can contribute to the commercial viability of heat networks.

However the question as worded reads 'required to connect to **new** district heat networks'. This could be interpreted as meaning that all new developments should be heated by a heat network. We would not support this approach, as it would not necessarily be the case that district heating networks would be the optimal solution for any new housing or commercial development. It may be that shared ground loops, or individual air source units are a better solution. This should be decided on a case-by-case basis by developers in line with LAEPs rather than a centrally mandated requirement.

**Q13. Hydrogen for heat: The strategy states that based on evidence gathered, heat pumps will be the championed solution for most building heat. Hydrogen's role will be in defined zones for high-temperature industry, as well as for wider net zero solutions prioritised by how useful hydrogen will be (known as 'the hydrogen ladder'). Do you agree that a clear statement is needed on hydrogen's role in meeting Wales' heat decarbonisation ambitions? (Yes/No) Please explain.**

Yes. Nesta does not agree that hydrogen is the best solution for domestic heating, for reasons set out [in this opinion piece](#), which summarises the findings of multiple pieces of independent research.

We believe a clear message from Welsh Government about its conclusions on the roles of the two technologies can only help build confidence for consumers, installers and the wider supply chain.

Hydrogen's role is likely to be limited, even in areas where it is widely used for industrial purposes. If it does play such a role in such areas, this is likely to be on much longer term timescales than are set out in the strategy route map.

So emphasising these long-term edge cases is likely only to contribute to uncertainty and ambiguity and slow down action in the short term.

## **Section 4: Improving the energy performance of our homes**

**Q14. A clear framework: Do you agree that stronger regulation is needed to encourage the uptake of low carbon heat and more energy efficient homes? (Yes/No) What other interventions must be implemented alongside stronger regulation to ensure no one is left behind?**

Agree, but we don't think that strong regulation should be seen as the main driver of heat pump adoption. Instead the priority in the short term should be using positive approaches, reducing costs, increasing appeal and positive experiences, and improving skills and supply chains. This should ensure any regulatory deadline for boiler phase out, for example, should be designed to become uncontroversial by the time it arrives - because the momentum is clear and consumer experience is positive. This should ensure householders don't feel that an undesirable technology is being forced on them.

For that reason, regulation should also primarily be industry-facing rather than consumer-facing. It should support high quality heat pump installations which deliver advertised coefficients of performance and therefore the lowest possible running costs. Open monitoring of heat pump performance standards should be mandatory, and this information could be used to identify low-quality installations to enable consumers to have problems addressed.

**Q15. Holistic approach to fuel poverty: The Warm Homes Programme has been offering new gas boilers, where appropriate, to those eligible., Do you agree that our future investments in energy efficiency must, where possible, simultaneously support our heat decarbonisation pathway? (Yes/No) Please explain and expand on opportunities to address fuel poverty holistically.**

Yes. There are two key reasons for this. Firstly, installing replacement gas boilers is ultimately not consistent with net zero targets, as noted by Audit Wales<sup>8</sup>.

Secondly, Nesta and others are recommending that the UK Government should reform the electricity market and address gas-to-electricity price ratios to improve the relative running costs of electric heat. If this is done successfully, there will eventually come a point where a gas boiler installed with the goal of tackling fuel poverty will in fact have the opposite effect and see costs higher than there would be.

When this point will come is hard to predict. In the interim, it will almost certainly be the case that fuel poverty programmes will want to provide fossil fuel based solutions. To mitigate the long-term detriment to net zero goals, policy should focus on boiler repair rather than replacement wherever possible. Whole house retrofits should be designed to improve heat pump readiness in homes which retain a fossil fuel system, considering resizing radiators and heat emitters and designing fabric improvements to support low temperature heating.

Boilers installed under fuel poverty schemes should be set at as low a flow temperature as possible, and householders should be given advice on how to run their heating system in this way to achieve comfort whilst using less gas.

This would be consistent with the updated Part L building regulations which

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<sup>8</sup> Audit Wales - The Welsh Government's Warm Homes Programme (2021)  
<https://www.audit.wales/publication/welsh-governments-warm-homes-programme>

new or completely replaced wet heating systems in existing homes, all system components to be appropriately sized to enable a maximum flow temperature of 55°C or lower. This could mean, for example, replacing radiators alongside a replacement boiler - which would increase heat pump readiness.

Heat pump readiness should also be an explicit component of messaging around the schemes, to inform people's expectations about the transition to low-carbon heat in the long term.

**Q17. Smart meters and variable tariffs: Do you agree that emphasis on smart meter rollout and variable tariffs are important to address now, to minimise bills during the transition to low carbon heat? (Yes/No)**

How best can Welsh Government support this, while advocating for those who are unable to participate in energy flexibility?

Yes. Nesta is undertaking multiple projects on energy flexibility, including real world trials of how effectively heat pumps can be used for this. We want to inform better long-term modelling and setting of price signals to incentivise heat flexibility.

Smart meter rollout will be hugely important to managing an all-electric energy system long term. What remains to be seen is how homeowners will benefit directly from household demand response. Whilst all users benefit from billions in lower system costs as modelled by National Grid under its Future Energy Scenarios<sup>9</sup>, some users may need to be directly rewarded for demand response to achieve this.

The demand flexibility service trial in winter 2022-23 used a price point of £3

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<sup>9</sup> National Grid ESO 'Future Energy Scenarios: Flexibility' (2023)  
<https://www.nationalgrideso.com/future-energy/future-energy-scenarios-fes/fes-sections/flexibility>

per kWh to reward households for turning down demand in pre-announced periods. It is unclear whether this is the expected level of incentive for domestic demand side response (DSR) in the long term / business as usual scenario. It is also unclear whether the system operator's expectation is that consumers will mostly be directly exposed to half hourly price variations and 'manually' respond (eg, by reducing thermostat temperatures in response to a prompt), or whether automated, aggregated demand response via third parties will be the norm.

In the latter scenario householders would ideally be unaware of how their demand was being controlled and shifted. They would maintain thermal comfort, and receive lower bills overall, without being specifically rewarded per event. Nesta's assumption is that automation is likely to be the better option for most households.

In either scenario, it may be that payments for kWh reduced may, in fact, be negligible to the extent that they do not - in themselves - justify potentially costly investments in tech like batteries, solar panels, or smart energy management systems.

We should also note that homes with low fabric efficiency and high heat loss are likely to have more overall demand which could therefore be flexed, compared to households with homes that are easier to keep warm. Flexibility capital in the form of high demand in poorly insulated homes is unlikely to be seen as worth the trade off in comfort and costs. Improving fabric and switching to efficient electric heat sources, may therefore remain the priority for Welsh Government policy in the short to medium term. Noting that inclusive design of smart energy products and services should of course be a key principle of reform.

These are open questions which Nesta and others are actively researching.

In the short term, protecting people less able to participate in flex is likely to mean ensuring that the price of non-variable tariffs remain affordable and fair. The Welsh Government should continue to work closely with consumer

organisations and fund advice which helps consumers understand which tariff is best for them in an increasingly complex future energy supply market.

**Q18. Upfront cost of heat pumps: Do you agree that dedicated long-term finance packages are needed to support the installation of heat pumps? (Yes/No) Please explain.**

Yes. We note that Nesta's research on behalf of the Development Bank of Wales (DBW) is referenced within the draft strategy. This is the main evidence base on which would support dedicated action from Welsh Government via DBW on this. Our work suggested government-backed finance could have a positive impact on the uptake of green upgrades in homes, as long as it was paired with appropriate advice and support.

We would welcome the opportunity to continue supporting DBW in its implementation of a finance product.

**A note on citation of Nesta's Green Finance work in the draft Heat Strategy**

On page 15, the draft strategy states that "[Nesta's] recent research shows that, when faced with the full costs, only 25% of homeowners would pursue green home upgrades, even with attractive financial support."

This slightly misrepresents the findings of our work. The 25% figure only covers participants in one of the nine treatment arms of the trial. This group was presented with an offer of a hypothetical government information and advice service (but not a finance product), and asked if they would access this support. They were subsequently shown the cost of measures, at which point 'take up' dropped from 55% (who said they would access the support), to 25% (who said they would proceed with green upgrades having seen the costs).

The 25% figure is therefore not generalisable across our whole trial sample, or indeed to the wider population.

Our research found that, compared to the control group, there was around a 10% increase across treatment arms in 'take up' of the finance product to install green measures when that product was presented as being government backed, and paired with advice and support.

We suggest this may be a more relevant figure to support Welsh Government action on green finance within the final Heat Strategy.

## **Section 7: Taking action**

**Q29 Costs and savings: The costs set out in the strategy are drawn from the Climate Change Committee analysis. Is there additional evidence on the costs and potential savings that we should consider?**

Nesta agrees with the Climate Change Committee's analysis on cost. Though we note that the seventh carbon budget is anticipated in the near future and that costs are liable to continue to change dynamically and significantly in the future. Policy implementation should be agile enough to respond to changes, anticipating and planning in advance how delivery might adapt to specific changes in cost. Particularly to energy prices.

**Q30. Our routemap: Do you agree that our policies routemap is sufficiently clear? (Yes/No) Please explain.**

The route map is clear. What is less clear is what assumptions it has made about wider conditions, and how it would adapt if those assumptions were overtaken by events. We believe a detailed route map is useful for the short

term (eg, to 2028), with a more scenario-based approach to pathways in the medium to long-term given the uncertainties involved.

**Q31. Our pathway: The strategy is based on the Climate Change Committee's Balance Pathway. Do you agree with this approach? (Yes/No) Please explain.**

Agree. Nesta's own work on decarbonisation takes the Balanced Pathway as the basis for our strategy, though again we note the anticipated update to CCC pathways.