Heat Pump Deployment in Wales

Full Report

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Heat Pump Deployment in Wales

Executive Summary

Headlines

- In 2022, Welsh Government turned to Local Area Energy Plans (LAEPs) as a tool to help Local Authorities (LAs) decarbonise local energy systems. These plans are the focus of this research project, centred upon assessing their potential impact. As an output of a six-month placement at a Gas Distribution Network (GDN), this report explores the implications, to GDNs, of the scenarios LAEPs present for the future of heat delivery.
- LAEPs champion a standardised, yet place based, approach to tackling local energy system decarbonisation. However, across most of the scenarios, for the majority of LAEPs in Wales, domestic heat decarbonisation is dominated by the proposed widespread adoption of heat pumps. It was found that there were also differences in modelling approaches utilised by the consultancies that developed the plans.
- Lack of clarity surrounding the coordination of the substantial infrastructure changes required to facilitate the vision of the LAEPs, means gas and electricity network operators are left to interpret time-distant deployment targets as one of the indicators for how energy system transformation may unfold.
- The analysis explores the challenges of achieving the heat pump deployment targets set out in the LAEPs. It shows that, without immediate acceleration, meeting these targets will require roll-out rates proportionally higher than the UK's heat pump installation rate targets and the current gas boiler replacement rate. Furthermore, the longer substantial progress is delayed, the more difficult it will be to manage the transition sustainably, as deployment rates may need to exceed natural replacement levels to meet 2050 targets.
- As more gas properties switch to heat pumps, GDNs will have to socialise their network costs across a shrinking customer base. The next price control period, 2031-2036, is when this could really start to impact GDNs. If heat pump deployment is not spatially coordinated, and license agreements and price control frameworks do not give GDNs the leverage to cope with the reduced demand, then their economic models are likely to be threatened.
- Whilst energy plans, including LAEPs, are not directive, and hold no regulatory legitimacy, their impact on stakeholders will be limited. Those tasked with implementing the plans have no real power to enforce them, meaning stakeholder engagement is discretionary. Such plans can be effective if they align with stakeholder interests, but when conflicts arise, organisational priorities will generally take precedence.

Background

This report examines LAEPs from the perspective of a GDN. It is an output of a six-month placement completed at Wales and West Utilities (WWU) – the GDN for Wales and the Southwest of England. The report begins by presenting the findings of an analysis conducted to assess the scale of heat pump roll-out required to meet targets set out in the LAEPs. It then explores the challenges that GDNs will face as heat delivery is decarbonised, focussing on the visions for the transition outlined within the LAEPs.

The transition to a net zero energy system presents significant challenges for long term infrastructure planning, particularly for GDNs. This is because, as the UK accelerates its efforts to decarbonise heat delivery, GDNs face increasing uncertainty over how quickly renewable heating technologies, such as heat pumps, will be deployed and what this means for future gas demand.

Recently, the Welsh Government turned to LAEPs as a key tool to help Local Authorities (LAs) manage these uncertainties and coordinate local energy system decarbonisation through a whole systems approach. Developed to support net zero targets and guide infrastructure investment, LAEPs aim to align local and national energy objectives while accounting for place-based constraints and opportunities. They are informed by technical evidence of the whole energy system, non-technical factors, and stakeholder engagement. The plans include details on supply, demand, and storage requirements and feature various renewable technology deployment targets, that help to paint a vision of the future energy system.

Research motivation

In Wales, the majority of LAEPs, across most of the net zero scenarios they present, opt for the widespread adoption of heat pumps as the preferred pathway for decarbonising domestic heat. They outline this vision using heat pump deployment targets, which act as an indicator for how heating system decarbonisation may progress. To help WWU interpret these targets, first an analysis was conducted to compare the roll-out rates required to meet them against historic installation rates. The process highlighted significant disparities between the two, as well as several issues with the LAEP targets.

In response to the issues, a second analysis (which makes up the basis of the report) was conducted to help visualise the scale of the challenge required to meet the targets and, in doing so, allow the implications of the deployment targets to be explored more comprehensively. The analysis includes 18 LAs in Wales. For each one, the analysis projects five heat pump deployment pathways through to 2050.

Research approach

The five deployment pathways considered in the analysis were:

1. **No Improvement:** heat pump deployment continues at the current rate.

2. **Match Gas:** by 2030, heat pump deployment rates match estimated current gas boiler replacement rates.

3. **Best-Case:** lowest possible deployment rate to achieve 2050 deployment target; hitting maximum rate by 2030 and starts merging into a replacement rate around 2045.

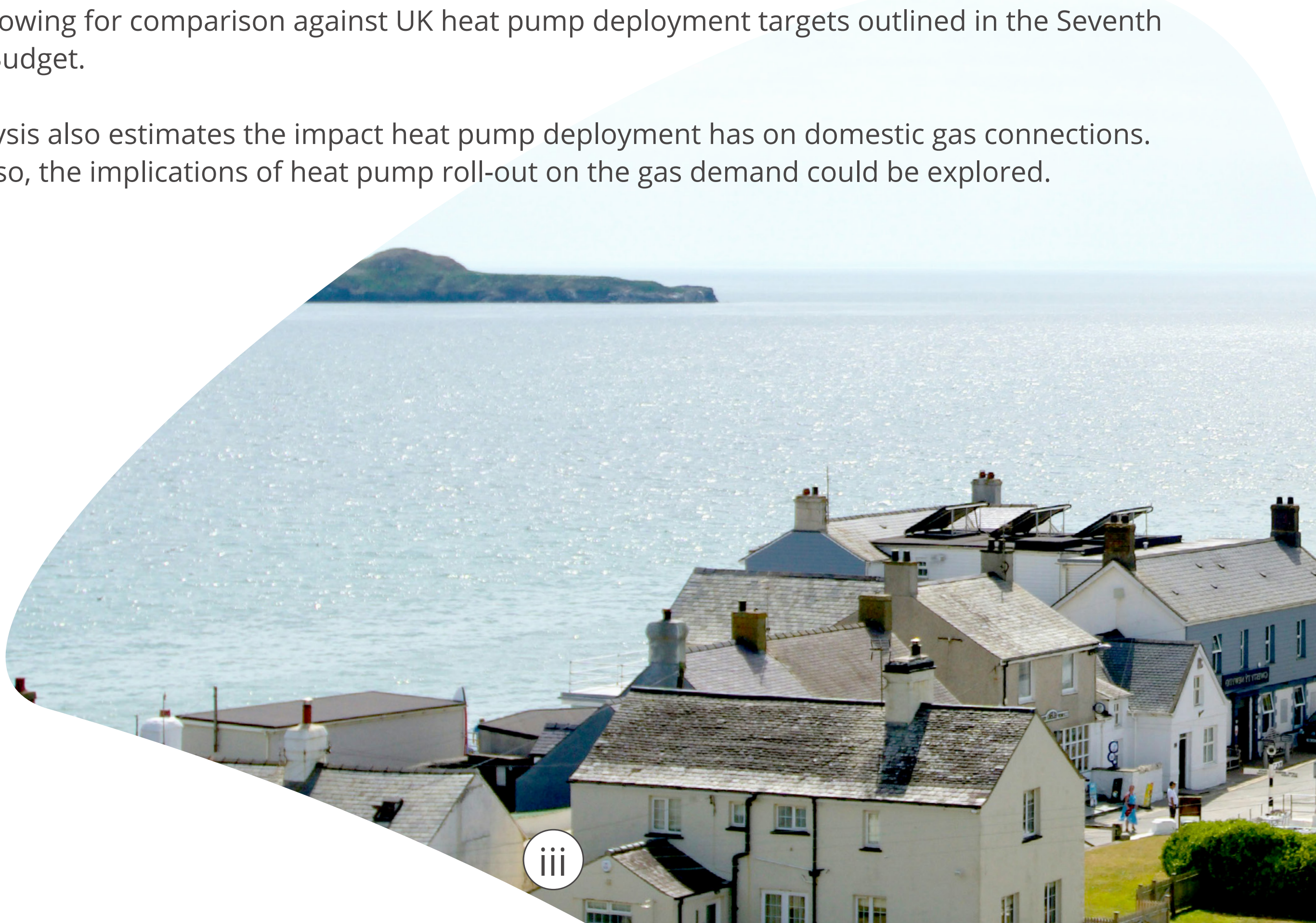
4. **Delayed Roll-Out:** a version of the 'Best-Case' pathway where more time is given (up to five years) to reach maximum deployment rate (adjustment made when the 'Best-Case' pathway was deemed unrealistic).

5. **LAEP Projections:** reflect LAEP aspirations, starting at the baseline year set within the plan (which varies depending on the LA) and ignoring all other historic data points.

To connect the historic installation data with the target data points (relevant to 'Match-Gas', 'Best-Case' and 'Delayed Roll-Out' pathways), an 'S-curve' adoption profile was used; adoption begins slowly with the early adopters, accelerates to a sustainable maximum deployment rate that enables widespread uptake, and then levels off as it merges into the replacement rate. This phenomenon is supported by the Climate Change Committee and is widely reported; solar panels, wind turbines, and lithium-ion batteries all followed such adoption curves.

For each pathway, the maximum deployment rates (the rate during the middle section of the 'S' curve) across each LA were combined, to give a combined maximum deployment rate. This allowed for comparison across pathways to see what impact changing certain parameters has on the roll-out rates required to meet deployment targets. The combined deployment rates were also scaled to UK-wide levels, allowing for comparison against UK heat pump deployment targets outlined in the Seventh Carbon Budget.

The analysis also estimates the impact heat pump deployment has on domestic gas connections. In doing so, the implications of heat pump roll-out on the gas demand could be explored.



Results

LAEP targets

Current trajectories fall short – if heat pump deployment carries on at its current rate none of the LAs will meet their 2050 target. This stresses a need for policy and market intervention to deliver the scale of roll-out required.

Deployment rates are as important as absolute targets – absolute targets for heat pump deployment fail to convey the true scale of the challenge, as they are time-distant and abstract. By detailing the deployment rates required to achieve the targets, it is easier to understand where the key challenges lie.

Supply chain and workforce constraints – even if heat pumps are installed at the same estimated rate that gas boilers are currently replaced, just under half of the LAs in the analysis don't reach their 2050 targets. This suggests that many LAEP targets rely on roll-out levels that exceed current local supply chain and workforce capacity.

Deployment rates – the analysis showed that making heat pump targets more achievable requires significant improvements in deployment rates (the number of heat pumps installed each year). In most cases, achieving the targets set for 2050, requires maximum deployment rates to be achieved and sustained from 2030 onwards. Any delay to this, increases the number of installations required each year if the 2050 targets are still to be met. For 12 of the 18 LAs analysed however, meeting maximum installation rate by 2030 appears unrealistic, because doing so requires significant increases from current levels of deployment. In six of the locations deemed 'unrealistic', this would require at least a thirty-fold improvement in heat pump deployment rate in the next five years.

Replacement rate – if heat pump deployment is to be sustainable, installation rates need to align with natural replacement cycles so that, once the market matures, the deployment rate merges into a replacement rate. However, the longer progress towards deployment targets is delayed, the more likely it becomes that roll-out rates will need to exceed sustainable replacements levels to meet 2050 targets. The greater the gap between deployment and replacement rates, the harder it will be to manage the transition sustainably, as, once the market is saturated, supply chains and the workforce will have to contract in line with reduced demand.

Disparity between national and local targets – in this analysis, if the deployment rates required for LAs to meet their heat pump deployment targets were repeated across the whole of the UK, total deployment rates would need to be well above the CCC target of 1,500,000 installations per year by 2035. If roll-out rates were to follow the CCC's trajectory, then the heat pump deployment targets, in the majority of the LAEPs analysed, would be missed. Considering this alongside the other findings, suggests that, in most cases, the heat pump deployment targets in the LAEPs reviewed are too high.

Impact on GDNs

Contrasting modelling approaches – LAEP heat pump deployment targets are a product of broad system modelling and the plans themselves are aspirational, unenforceable, and, as this analysis has shown, may not be achievable. GDNs, on the other hand, make their forecasts by exhaustively modelling data from hundreds of thousands of meter points (depending on the size of the network), in weather sensitive demand models. This forecasting approach is highly robust and is a key part of ensuring they conform to the licence conditions that govern their operations. Since LAEPs do not face the same consequences, they can afford to be speculative. However, in being so, their influence on gas network forecasts is limited, as GDNs cannot risk basing their projections on aspirational targets, as it is highly unlikely that the regulator, Ofgem, would allow them.

Transitional considerations – total gas consumption is predicted to follow the inverse of the 'S-curve' that has been used to project heat pump deployment in this analysis. The consequence of this is that the next price control period (2031-2036) will be a critical juncture for GDNs. If heat pump deployment targets are to be achieved, then heat pump roll-out will need to be reaching maximum levels during this period, resulting in precipitous decreases in gas demand. If Ofgem does not anticipate heat pump roll-out to dramatically increase during this period and they don't give networks the levers to deal with it if it does, then this could mean one of two things:

1. LAEP targets will be very difficult to achieve – if real progress on heat pump deployment is not anticipated until after 2036, then this analysis suggests that widespread adoption of heat pumps as the solution to domestic heat decarbonisation will not be feasible within the limits of the supply chain and workforce capacity. As a consequence, other means of decarbonising heat networks will have to be sought to meet the 2050 targets.

2. The gas network risks becoming uneconomical to operate – if heat pump deployment does proceed as required to meet LAEP targets, and Ofgem does not make anticipatory changes to the price control framework and/or GDN's licence agreements, then gas networks will have to socialise their costs across a rapidly declining client base, which can only be commercially viable for so long.

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1 – Introduction

This report is an output of a placement that was conducted at Wales and West Utilities (WWU), who are the Gas Distribution Network (GDN), for Wales and the Southwest of England. The report is written as both an independent deliverable, to WWU – for the sponsor of the work, Cultivate Innovation – and as a contribution to a PhD thesis, that explores the impact of Local Area Energy Plans (LAEPs) in Wales.

The transition to a net zero energy system presents significant challenges for long term infrastructure planning, particularly for GDNs. Because, as the UK accelerates its efforts to decarbonise heat, GDNs face increasing uncertainty over how quickly renewable heating technologies, such as heat pumps, will be deployed and what this means for future gas demand.

Recently, the Welsh Government turned to LAEPs as a key tool to help Local Authorities (LAs) manage these uncertainties and coordinate local energy system decarbonisation through a whole systems approach. Developed to support net zero targets and guide infrastructure investment, LAEPs aim to align local and national energy objectives while accounting for place-based constraints and opportunities (ES Catapult, 2025). They are informed by technical evidence of the whole energy system, non-technical factors, and stakeholder engagement (Colins and Walker, 2023). The plans include details on supply, demand, and storage requirements and feature various renewable technology deployment targets, that help to paint a vision of the future energy system.

Typically, LAEPs are self-funded by an LA (although, in Wales, they were commissioned by the Welsh Government) and take the form of a report which is generally split into:

- Introduction – defines the scope and identifies the stakeholders.
- Current energy system – lays out the local context and provides baseline figures for energy-related metrics.
- The future energy system – presents different scenarios for reaching net zero and outlines technology deployment targets.
- Action planning – proposes a route map with timescales, responsible parties, and next steps.

Whilst the LAEPs present visions for the future energy system across multiple different scenarios, which offer alternative visions for how it could decarbonise, the changes they propose are often dependent on infrastructural changes being made by gas and electricity networks. Hence the impact of LAEPs is partially anchored to the pace of the transformation of these networks. Because of their nascence, it's hard to gauge, from literature alone, where the key conflicts lie between what the plans envisage and the operational realities of the energy networks. Such conflicts are likely to impede plan implementation because stakeholder cooperation is discretionary; understanding where the conflicts lie is therefore crucial to uncovering what impact LAEPs will have.

The focus of this report is to capture the implications of the LAEPs from the perspective of a GDN. It begins by presenting the findings of an analysis conducted to assess the scale of heat pump roll-out required to meet targets set out in the LAEPs. The report then explores the challenges that GDNs will face as heat delivery is decarbonised, focussing on the visions for the transition outlined within the LAEPs. In doing so, it highlights key practical considerations for gas network management that must be addressed to enable successful decarbonisation – particularly the need to manage the transition within the constraints of existing licence agreements and to ensure the ongoing financial viability of the network in the context of rising consumer costs.

2 – Background

2.1 – Where do LAEPs fit in the energy planning landscape?

Local Area Energy Planning, emerged from an Energy Technologies Institute (ETI) programme, led by the Energy Systems Catapult (ES Catapult) from 2015-2017, to decipher the most effective means of decarbonising the UK's housing (ES Catapult, 2023). Over the last decade, LAEPs have become the most prominent form of local energy planning in the UK. There are, however, a couple of other forms of planning which will intersect with LAEPs, that need to be understood in order to assess the potential impact of LAEPs on gas networks.

2.1.1 – Regional Energy Strategic Planning (RESP)

Recently the National Energy System Operator (NESO) has emerged as a key player in the energy planning landscape – having been licenced, by the Office for Gas and Electricity Markets (Ofgem – the UK's energy regulator), to develop three new forms of energy plan:

- Centralised Strategic Network Plan (CSNP) – purposed with making a network "blueprint" for Great Britain by "...mapping demand and optimal locations for onshore and offshore transmission infrastructure to support a decarbonised energy grid" (NESO, 2025a).
- Strategic Spatial Energy Plan (SSEP) – developed to establish "...the best places, amounts, and kinds of energy infrastructure..." needed to meet energy needs in Great Britain (NESO, 2025c).
- Regional Energy Strategic Plan (RESP) – tasked with helping "...local areas get the energy infrastructure they need to meet local net zero targets and growth ambitions, and help communities to access reliable, clean and affordable energy", ensuring a "joined-up approach between national, regional, and local levels" (NESO, 2025b).

The most relevant to the context of the analysis reported here, are RESPs, because they too are focussed on decarbonising sub-national energy systems – albeit at a much larger scale than LAEPs – using a whole-systems methodology. The intention is for these plans to be more directive than LAEPs, helping to guide infrastructure investment through the net zero transition (Ofgem, 2024a).

NESO is currently developing a transitional RESP (tRESP) – to be released by the end of 2026 – that will focus on supporting the business plans of electricity Distribution Network Operators (DNOs). They aim to deliver full RESPs, which will include GDNs, by the end of 2027.

In their 'Regional Energy Strategic Plan Policy Framework' consultation, Ofgem state that they "...expect the RESP to support local government planning (e.g., LAEPs...", and they also list LAEPs as one of ten local government data, bottom-up, inputs (Ofgem, 2024a). In response to a question on ES Catapult's website, of whether RESPs negate the need for a Local Area Energy Plan, they state "In short, no. A good LAEP will benefit the RESP, because RESPs are a way of coordinating the local with the national and will draw up local data [including LAEPs] to inform decision making" (ES Catapult, 2025).

It seems therefore, that LAEPs will feed into RESPs, but exactly how the two will interact is yet to be determined. Given the commitments of RESPs to adopt a similar, whole-systems approach to decarbonising regional energy systems, it is apparent that findings from this report may also be relevant to the RESP process as well as later iterations of LAEPs.

2.1.2 – Internal planning

Whilst not specifically a form of local energy planning, the other form of planning which interacts with LAEPs, are the internal business plans that GDNs and DNOs develop in response to the regulatory framework produced by Ofgem – known as RIIO (Revenue = Incentives + Innovation + Outputs). The RIIO framework runs in phases, called price control periods, which usually span five years. The timeframes for these control periods differ for DNOs and GDNs; for gas networks, the current period, RIIO-GD2, ends in 2026. RIIO-GD3 will run from 2026-2031, RIIO-GD4 from 2031-2036, and so on. For DNO's, the control periods start and finish two years later: RIIO-ED2 started in 2023 and ends in 2028, and RIIO-ED3 will run from 2028-2033, etc.

The business plans outline how each network intends to operate, innovate, and invest in their network over the upcoming regulatory term (Ofgem, 2024b). Designed to regulate the investments that networks can make and ensure they make enough revenue, the frameworks are deliberately rigid to ensure monopoly companies provide a fair price for consumers. This means however, that once the framework has been set, and business plans have been finalised, there is limited flexibility outside the defined parameters. Hence, if net zero aspirations are to be met, it is key they feed into the formation of the RIIO business plans. The impact LAEPs can have on GDNs therefore, is anchored to the RIIO framework for each price control period.

2.2 – Limitations of LAEPs for GDNs

A limitation of LAEPs is that, while they specify deployment targets for technologies like heat pumps, they typically do not detail the infrastructure changes required to enable those deployments. This means that GDNs have to interpret the targets themselves, to understand what implications they may have. In this context, they act as a signal for how the local energy system is expected to evolve.

The usefulness of these targets for network planning, however, depends on two critical factors:

- How accurate they are
- Whether they conflict with existing licence conditions

These two points are interlinked, because, if the targets are accurate, then questions arise around whether the changes that need to be made to the networks, as the energy system evolves, can be managed under existing licence agreements.

2.3 – Why focus on heat pumps?

The latest iteration of the LAEPs presents different scenarios for how the delivery of heat demand will evolve as the heat network decarbonises. In many of these scenarios, the gas network is anticipated to run at reduced capacity. Often, the predicted reduction in gas demand is caused by the gradual electrification of heat delivery, where demand is met by the widespread adoption of heat pumps. Implicit to this, is sections of the gas network being phased into obsolescence. Therefore, in some cases, the implications of LAEP heat pump targets to GDNs, should they materialise, are severe.

If heat pump deployment targets proved to be realistic/achievable with respect to historic data, they could be used to predict how heat pump roll-out is likely to progress. From this, GDNs could begin to plan for changes they need to make to the network to handle the resulting gas boiler disconnections.

In supporting the analysis reported here, WWU were also keen to assess the availability of data. Depending on its granularity, this could help them determine the impact of heat pump deployment on their network or at least indicate trends in technology adoption.

2.4 – What do LAEP heat pump targets look like?

In Wales, the LAEPs were produced by three different consultancies: Arup, City Science, and ES Catapult. Each consultancy has its own model for predicting future energy system transformation and heat pump deployment targets are outputs of those models. The granularity and nature of these projections varies depending on the consultancy, but all LAEPs at least contain a 2030 and a 2050 target for heat pump deployment.

These targets are presented by each consultancy as follows:

- Arup – 2030 and 2050 heat pump installation targets for domestic and non-domestic properties combined
- City Science – separate targets for domestic and non-domestic heat pump installations, in five-year intervals
- ES Catapult – targets for domestic heat pump installations only, in five-year intervals

Whilst LAEPs provide a number of scenarios for different ways to decarbonise the energy system, most of them only provide one set of heat pump deployment targets. On occasion, it is unclear exactly which scenario these targets are associated with, and in these cases it has been assumed that the targets are for the highest electrification scenario – i.e. where heat pumps are most widespread. Although, for many of the LAEPs, the percentage of heat pumps in the 2050 heating technology mix does not vary significantly across scenarios.

However, some LAEPs present significant variations in heat pump deployment across the different scenarios. Hence, while the term 'deployment target' will be used throughout the report, it is important to note that for some LAs, this target is not necessarily representative of their ambitions for heat pump roll-out, but rather for the upper bound of what could be possible.

2.4.1 – How do the consultancies get the target figures?

Exactly how the consultancies reach the targets is unclear, for two reasons:

1. The models are opaque – it's difficult to tell what assumptions have been made or what logic has been used, to reach the target figures.
2. The baseline inputs are not always referenced – in some instances it's hard to know whether the baseline figures are accurate because it is unclear as to where the figures have come from.

3 – Motivation for the analysis

The motivation for this analysis emerged from a process completed to compare actual heat pump installation rates across Wales with those required to meet LAEP deployment targets. The results from this comparison – presented cumulatively across all LAs in Wales – are illustrated in Figure 1.

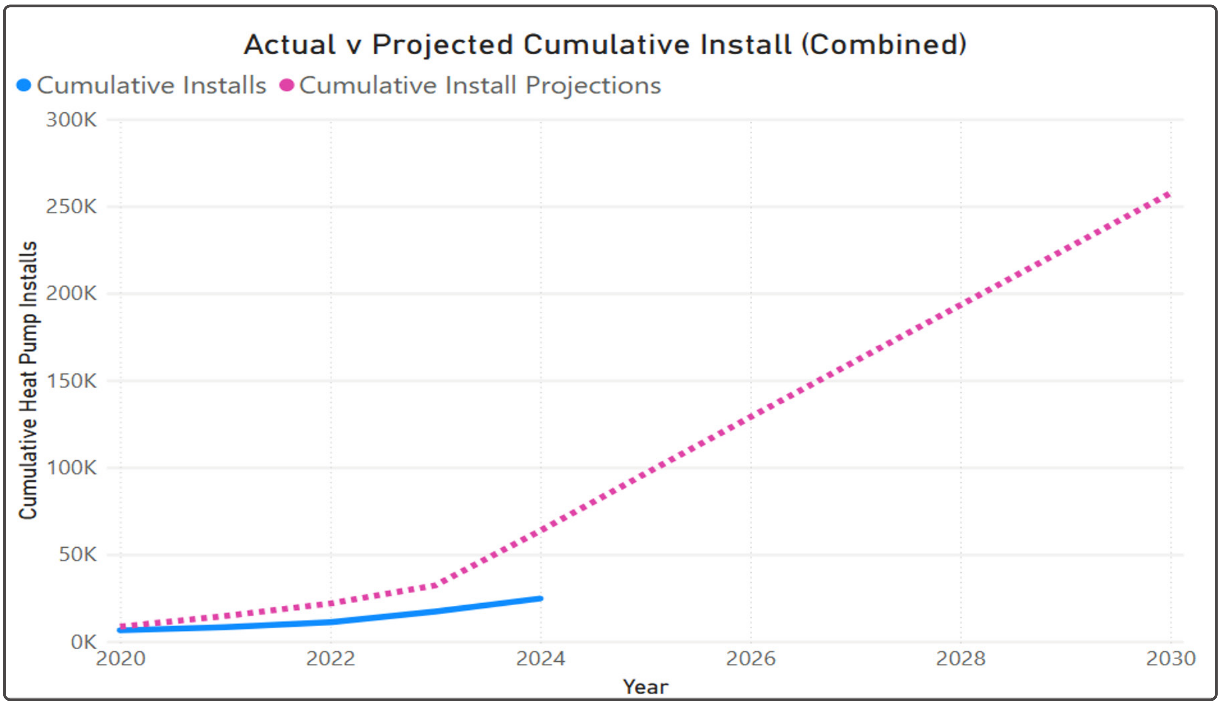


Figure 1 - Actual heat pump installations against LAEP heat pump installation targets, Wales

Figure 1 suggests that one year after the latest iteration of LAEPs had been established, cumulative heat pump deployment in Wales was around 40,000 heat pump installations behind a trajectory (albeit a linear one) that would deliver the 2030 deployment targets. This raises questions around onward delivery because, if heat demand is to be largely met by heat pumps, future deployment rates will have to increase (beyond those already required) to make up for the shortfall.

This analysis also highlighted some key issues surrounding the LAEPs and heat pump data collection, which form the basis of this report:

1. Current heat pump installation rates are lower than would be required to meet targets.

2. LAEPs often don't specify the annual deployment rates needed to meet targets, and where they are given, they are not done with consideration of the gradual increases in deployment that are consistent with the early stages of renewable technology adoption curves (see section 5.1).

3. There is a lack of consistency in the models used to produce deployment targets, which has led to significant differences in model outputs, making comparisons and aggregation difficult.

4. It is difficult to track progress against targets because accessing reliable, up-to-date heat pump installation data is challenging.

5. Deployment targets quickly become outdated if LAs fall behind schedule.

6. Most LAEPs don't distinguish between commercial and domestic installations, or air source and ground source heat pumps.

7. It can be unclear which heat network decarbonisation scenario the heat pump targets are associated with.

8. Whilst LAEPs do present heat network decarbonisation in different scenarios, in most cases there is little variation in predicted heat pump deployment, as a percentage of future heating technology mix.

9. Some LAEPs assume constant deployment rates as they approach 2050, resulting in projections that overlook the reduction in deployment rates that are likely to occur as full deployment nears, due to maintenance, replacement requirements, and consumer resistance.

10. It is very difficult to determine what impact heat pump deployment will have on the gas network because the LAEPs do not identify the type of central heating being replaced, or where (within a locality) this will occur.

In response to these issues, further analysis was conducted to help visualise the scale of the challenge required to meet the targets and, in doing so, allow the implications of the deployment targets to be explored in more detail . The analysis was designed to:

- Provide a grounded, data-informed forecasting approach – by curve fitting to previous data points, all projections are informed by real data, to reflect current deployment rates.
- Display different pathways for how heat pump deployment may progress – considering different heat pump deployment trajectories offers a clearer picture of what impact faster/slower uptake has on projections.
- Investigate the deployment rates required to achieve the targets set by the LAEPs – by outlining the yearly deployment rates required to achieve the LAEP targets, the challenges that achieving said targets would bring, can be more effectively explored.
- Acknowledge changes in deployment rate as adoption becomes more widespread – recognising that deployment rates will initially increase before stabilising at a level that enables widespread adoption, then reduce as the ultimate deployment target is approached and the deployment rate merges into a replacement rate.
- Indicate what impact heat pump deployment could have on gas demand – by estimating the percentage of heat pump installations that replace a gas boiler, an approximation can be made for the impact of heat pump roll-out on gas demand.

4 – Methodology

4.1 – Analysis parameters

As the analysis was undertaken whilst on placement at WWU, it was restricted to local authorities (LAs) on their network (excluding those where WWU are not the majority gas supplier). Within this scope, LAs were selected based on whether they had an LAEP which detailed 2050 heat pump deployment targets. Whilst WWU's network spans parts of England as well, none of the LAs in England, on their network, matched the requirements for the analysis. This left 18 LAs as being suitable for inclusion, all of which are in Wales.

4.2 – Data collection

4.2.1 – LAEP target installations

As previously mentioned, the granularity and form of the heat pump deployment targets differ across the LAEPs depending upon which consultancy delivered them. For each LA, the heat pump deployment targets were taken from the LAEPs.

4.2.2 – Historic heat pump installations

Data for historic heat pump installations was collected between 2020-2024. This range was selected to align with the 2020 baseline of some LAEPs. But also, having five years of historic data would help meet one of the analysis' objectives of providing a more data-informed forecasting approach.

To obtain this data, the Microgeneration Certification Scheme (MCS) Data Dashboard was utilised. The scheme is government-backed and was established to make sure small-scale renewable energy installations, like heat pumps, meet quality standards (UK Government, 2018). To qualify for the 'Boiler Upgrade Scheme' – a grant of up to £7,500 for homeowners in England and Wales to encourage heat pump adoption – a heat pump must be installed by an MCS certified installer (MCS, 2024). The data dashboard captures all MCS accredited heat pump installations.

As the MCS Dashboard does not include data for heat pumps installed in new builds, an estimation for the number of heat pumps in new builds is included. This is based off a widely referenced (in grey literature) estimate for the percentage of new builds built with a heat pump (5%) between 2019-2023 (Day, 2023; Schwerdtfeger, 2024). This percentage is multiplied by the number of new homes built each year in an LA according to a 'New Dwellings' register at StatsWales (Gov.Wales, 2025). The figure was then added to the MCS data of yearly installations.

4.2.3 – Gas boiler replacement rate

Throughout the analysis the gas boiler replacement rate is used as a reference point for supply chain and workforce capacity for heat pump deployment, since it is likely that firms currently fitting gas boilers will be the ones installing heat pumps in the future. This was calculated by taking the National Gas Boiler Replacement Rate – 1,800,000 (CCC, 2025) – and apportioning it to each LA according to the number of domestic gas boilers in their jurisdiction (based on 2021 census data; ONS, 2021). Appendix A contains a more detailed explanation for the calculation of this rate.

4.2.4 – Gas boiler disconnections

Since not every heat pump installed is replacing a gas boiler, a coefficient needed to be applied to yearly heat pump deployment projection figures, to give an estimate for resulting gas boiler disconnections. For each LA, this was undertaken by multiplying the number of heat pumps installed by the ratio of domestic gas boilers in the locality (from 2021 Census data; ONS, 2021) to the 2050 heat pump target.

4.2.5 – Total gas consumption

The total gas consumption value is required in the analysis to compare trends in gas demand between WWU's forecast and those calculated in the analysis. This figure was taken from WWU's meter-point data. The total annual consumption for each LA included in the analysis was summed to give a figure for the total annual consumption in Wales. Since WWU's meter-point data is confidential, axes displaying meter-point data have had values redacted.

4.3 – Uncertainties

The analysis has some key uncertainties:

1. MCS data coverage
   - It is assumed that all heat pump installations in existing properties are captured by the MCS Data Dashboard, as most heating retrofits are expected to take advantage of the government grants which require MCS certification.

2. New build installation rate
   - A uniform rate of 5% of new build homes being fitted with heat pumps (2019-2023) is applied across all LAs (Day, 2023; Schwerdtfeger, 2024).
   - In the absence of a better estimation, the 5% was applied to 2024 data points as well.
   - The approximation is only applied to new build houses; flats and apartments are not included.

3. LAEP target definitions
   - In cases where LAEPs do not specify the type of heat pump (air source or ground source) it is assumed that both are included in the headline figures.

4. Inconsistent data between LAEPs
   - The Arup heat pump deployment targets include non-domestic installations. The non-domestic installations, however, are assumed to be negligible in comparison to the domestic installations. Hence, in the analysis, they have been ignored (so that installation rates from all the LAs can be combined and scaled).
   - Despite efforts to align data types of historic data points with LAEP projections, complete consistency cannot be guaranteed. This makes exact comparisons between projected and actual figures inherently uncertain. Comparisons across LAs, and combined and scaled installation figures, should therefore be interpreted with an awareness of these underlying discrepancies.

5. Gas boiler replacement rate
   - For LAs whose LAEP heat pump targets include non-domestic installations, the gas boiler replacement rate will likely be higher than estimated, because it is a function of the number of domestic gas boilers in an area.

6. Gas boiler disconnections

- Given the emphasis in some LAEPs to target heat pump installations into off-gas properties in the early stage of technology roll-out, applying a standard coefficient to all heat pump installations will likely overestimate the number of gas boiler disconnections in the short-term and underestimate them in the long-term.

- The number of gas boiler disconnections will likely be larger than estimated in LAs whose LAEP heat pump targets include non-domestic installations, because the coefficient applied to heat pump installations is a function of domestic heat pumps only.

7. Total gas consumption

- Gas consumption trends from the analysis are not directly comparable to WWU's forecasted demand for Wales because the trends in the analysis only include demand data from 18 of the 22 LAs in Wales.

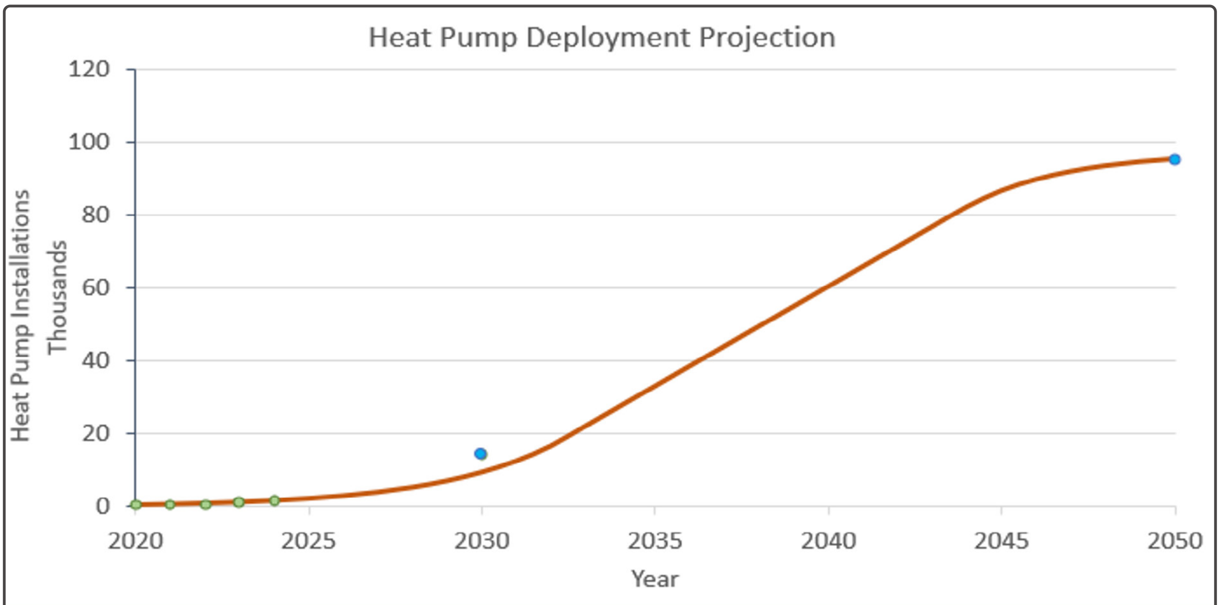
Considering the uncertainties identified, it is important to recognise that the figures presented in the analysis are indicative and have been interpreted on that basis throughout the subsequent results section and discussion; they should not be considered exact or cited as definitive.

5 – Analysis structure and pathways

5.1 – Analysis design overview

To connect the actual installation data points to the target data points, a heat pump deployment profile had to be decided on. An 'S-curve' is a common adoption profile that most new technologies follow. This curve shape is documented in the 'Diffusion of Innovation' (Rodgers, 2015), which explains how, why, and at what rate new innovations spread through cultures or social systems. Rodgers identifies five types of adopters, based on their readiness to embrace innovations – innovators, early adopters, early majority, late majority, and laggards. Adoption over time typically follows an 'S' shape, it starts slowly with the early adopters, accelerates to a sustainable maximum deployment rate that enables widespread uptake, and then levels off as the market saturates and the deployment merges into a replacement rate. The 'S-curve' phenomenon is widely reported – solar panels, wind turbines, and lithium-ion batteries all followed such adoption curves (Benham, 2023). The Climate Change Committee (CCC) also expect low-carbon technology uptake to "...follow familiar S-curve dynamics", (CCC, 2025). This 'S-curve' is reflected in the analysis (see Figure 2) through a combination of three lines which combine to make an 'S' shape:

- Exponential growth curve (start)
- Maximum deployment rate (middle)
- Exponential decay curve (end, exclusive to pathways that reach their 2050 target)



Which pathway?	First year at max deployment	Max deployment rate (units/year)	Start to mop up remainders
Delayed Roll-Out	2033	5500	2045

Figure 2 - Heat pump deployment projections in 'Delayed Roll-Out' pathway

For any given year, the shape of the curve is informed by the minimum value of these three lines – resulting in one, deployment line. The green points (on the left) are historic data points; the blue points (on the right) are LAEP targets. The box in the bottom left corner denotes the analysis pathway. The adjacent boxes, denote the first year at maximum deployment, the maximum deployment rate, and the year when remainders start being mopped up (to be ignored in pathways where the target is not achieved), respectively.

There are four inputs that each alter the shape of the three input lines, which, in turn, alter the shape of the projection line:

- **Initial Delay** – delays the start of the exponential growth curve, determining how many years elapse before significant uptake begins.
- **Curve Shape** – controls the steepness of the exponential growth segment, affecting how rapidly installations ramp up.
- **Max Rate** – limits the middle section of the curve to a maximum annual installation rate, so that deployment rates stabilise.
- **Mop-Up** – this dictates when deployment rates start to reduce (as technologies become more widespread and the roll-out rate merges into the replacement rate).

These inputs are set according to the pathway being analysed. In the aim of providing a grounded, data-informed forecast, four of the five pathways involve curve-fits to historic data. In the curve fitting process, only the curve shape is adjusted – all other inputs are fixed or constrained within defined ranges.

5.2 – Pathway development

In the analysis, for each LA, there are five deployment pathways
(which are visually displayed in Section 6):

1. **No Improvement:** heat pump deployment continues at the current rate
2. **Match Gas:** by 2030, heat pump deployment is at the rate gas boilers are currently being installed at
3. **Best-Case:** lowest possible deployment rate to achieve 2050 deployment target. Hitting maximum rate by 2030 and starts to level off in 2045
4. **Delayed Roll-Out**: a version of the 'Best-Case' pathway where more time is given (up to five years) to reach maximum deployment rate (adjustment made in LAs where the 'Best-Case' pathway is deemed unrealistic)
5. **LAEP Projections:** reflect LAEP aspirations, starting at the baseline year (which varies depending on the consultancy) and ignoring all other historic data points

Table 1 displays the limits on the four inputs, outlined in Section 5.1, that bound each pathway:

Table 1 - Input boundaries by pathway

Pathway	Initial Delay	Curve Shape	Max Rate	Mop-Up
No Improvement	Set so maximum deployment rate starts in 2024.	Changed in curve fit to historic data points.	Most recent years deployment.	N/A – as no LAs meet their deployment goals.
Match Gas	Maximum rate set to start by 2030.		Maximum of most recent years deployment or gas boiler replacement rate.	Set so mop-up starts by 2045, except when LA is not close to meeting their target, then is ignored.
Best-Case	Maximum rate set to start by 2030.		Lowest possible deployment rate needed to meet 2050 target.	Set for mop-up to start in 2045.
Delayed Roll-Out	Maximum rate set to start between 2030-2035, depending on how well heat pump deployment has progressed in an LA.		Lowest possible deployment rate needed to meet 2050 target, after start date adjustment.	Set for mop-up to start in 2045.
LAEP Projections	Varies depending on the consultancy that produced the LAEP.	Changed to fit line through targets.	Unrestricted: adjusted to pass through LAEP targets.	Pathway dependent – in ES Catapult and City Science there is no mop up and in Arup it begins in 2042.

5.3 – Demonstrating the impact on WWU's network

For each of the outlined pathways, there is a corresponding impact on gas demand.

5.3.1 – Effect on gas disconnections

While heat pump deployment trends offer GDNs an indication of how domestic heating may decarbonise over time, they do not directly equate to reductions in gas demand. This is because not every heat pump installation replaces a gas boiler – such as installations in new builds or off-grid properties. Figure 3 illustrates this point, by showing the correlation, in Wales, between the percentage of off-gas properties in an LA in 2017 (before any major heat pump deployment began) and the percentage of properties with a heat pump in 2024.

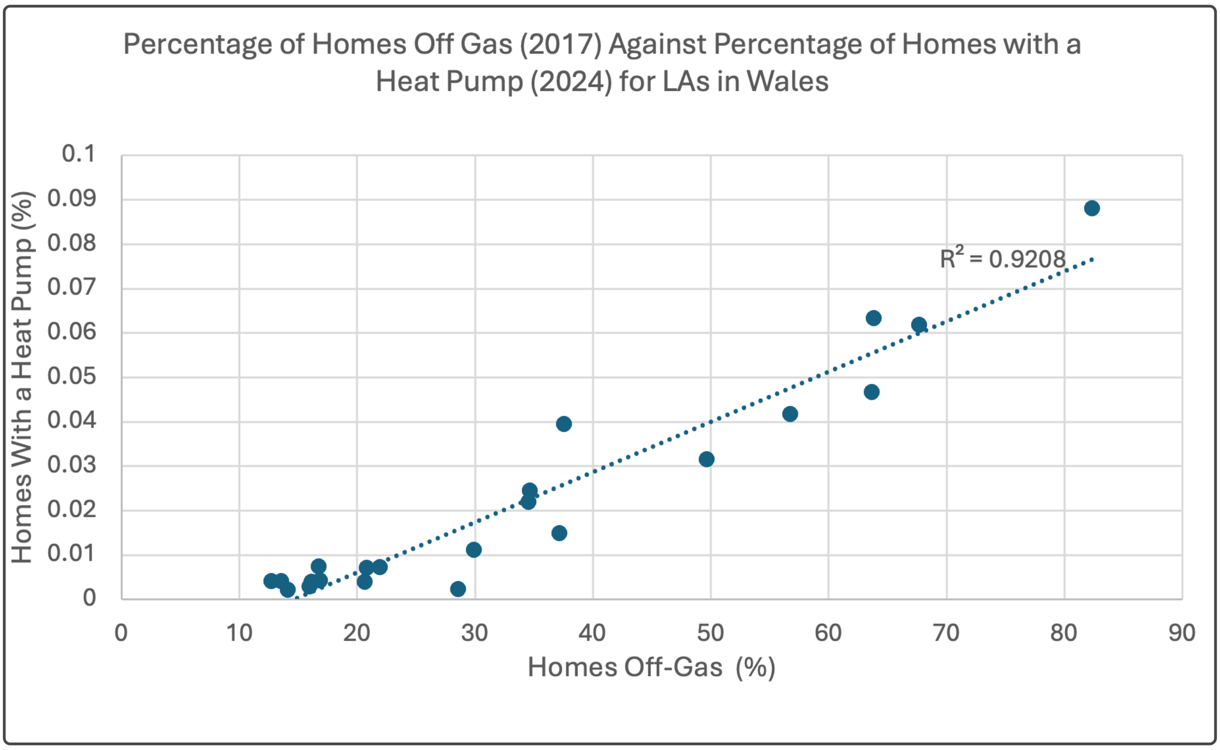


Figure 3 - Correlation between off-gas properties and heat pump installations

The observed correlation suggests that off-gas properties are being targeted in early stages of heat pump roll-out. This is consistent with some of the LAEPs which state that off- gas properties should be prioritised for heat pump installations. As a result, a percentage of yearly heat pump installations, will have no impact on the gas network. The number of heat pump installations each year were multiplied by a coefficient (outlined in Section 4.2.4) to get an estimate for how many can be expected to replace to a gas boiler. The result for one LA, Flintshire, is displayed in Figure 4. The 2021 figure for domestic gas connections comes from central heating census data (ONS, 2021).

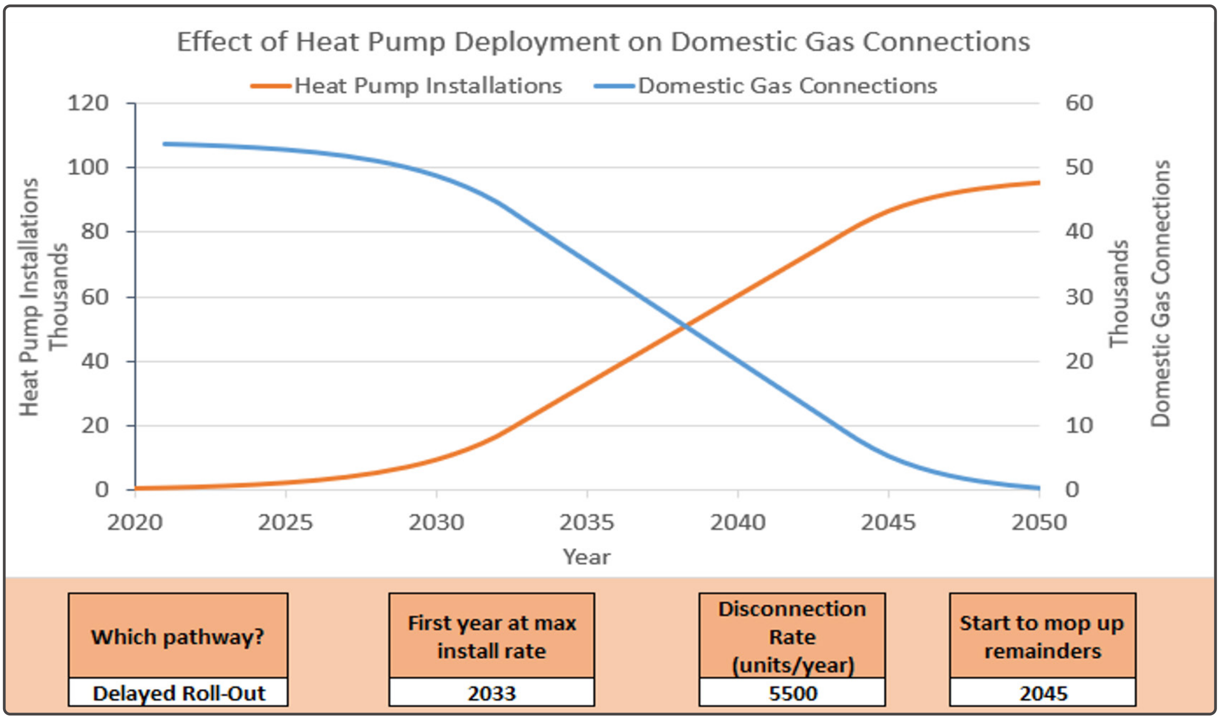
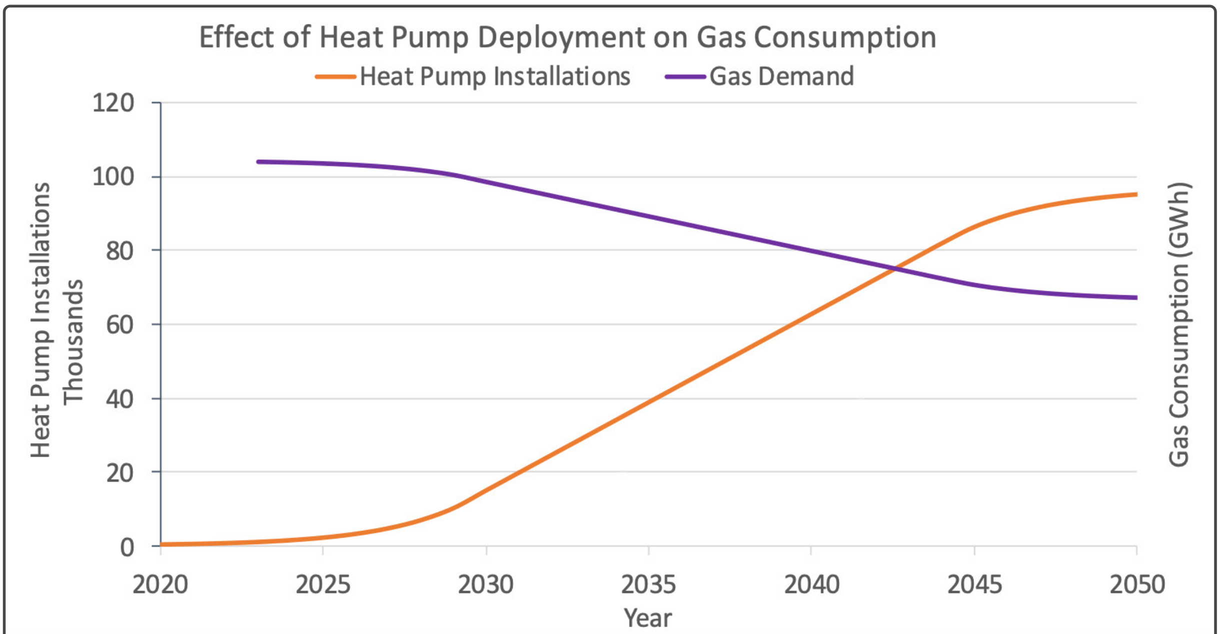


Figure 4 - Resulting gas disconnections, in 'Delayed Roll-Out' pathway, Flintshire

5.3.2 – Effect on gas consumption

The analysis also estimates the impact of gas boiler disconnections on overall gas consumption. To do this, the number of heat pumps replacing domestic gas boilers each year, was multiplied by a value of 11,500kWh – the average annual gas usage per UK household (Ofgem, 2025). This value was then subtracted from total consumption (based on WWU's 2023, meter point data). The impact heat pump deployment is estimated to have on gas demand in Flintshire, is shown in Figure 5. The gas consumption figures (on the secondary y-axis) have been redacted to respect data privacy.



Which pathway?	First year at max install rate	Disconnection Rate (units/year)	Start to mop up remainders
Delayed Roll-Out	2030	4800	2045

Figure 5 - Predicted reduction in gas demand in 'Delayed Roll-Out' pathway, Flintshire

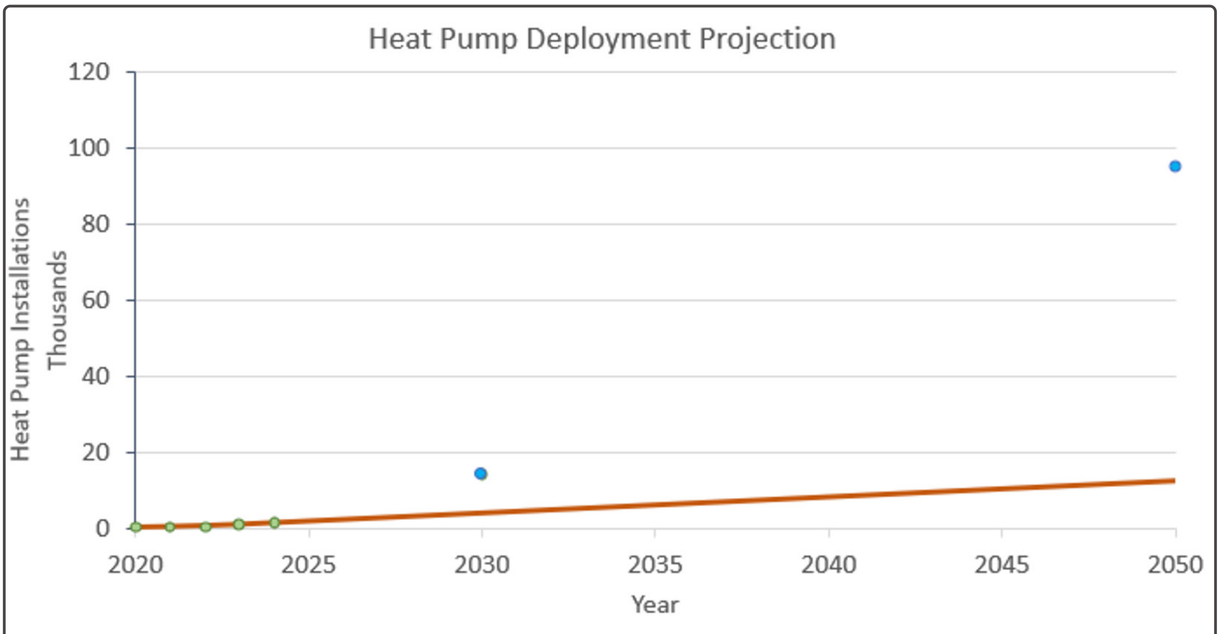
6 – Analysis visualisations

This section presents the five outlined deployment pathways in more detail, using data from Flintshire as an example.

6.1 – Heat pump deployment pathways

6.1.1 – No Improvement

Heat pump deployment continues at its existing rate (400 units per year) until 2050.
Figure 6 demonstrates that, under these conditions, Flintshire would fail to meet both their 2030 and 2050 targets.

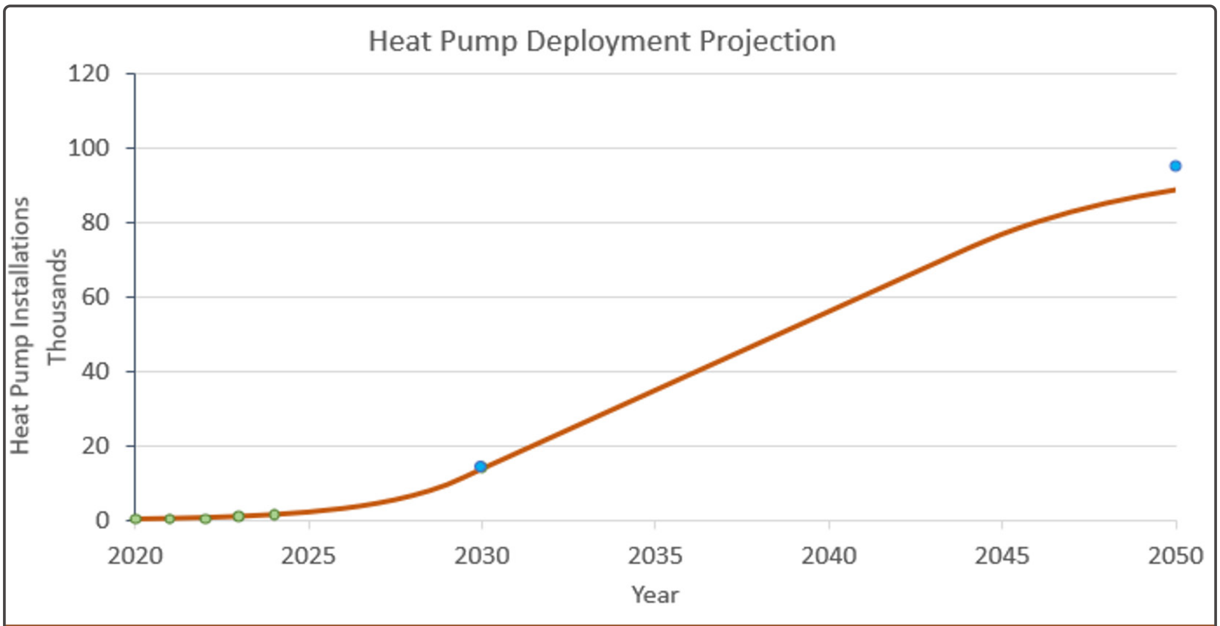


Which pathway?	First year at max deployment	Max deployment rate (units/year)	Start to mop up remainders
No Improvement	2024	400	N/A

Figure 6 - Heat pump deployment projection in ‘No Improvement’ pathway – Flintshire

6.1.2 – Match Gas

In this pathway, the maximum deployment rate was set to match the gas boiler replacement rate. Figure 7 shows what the deployment projection would look like if, by 2030, heat pump deployment in Flintshire were occurring at the same rate as boiler replacements are estimated to be occurring currently.



Which pathway?	First year at max deployment	Max deployment rate (units/year)	Start to mop up remainders
Match Gas	2030	4200	2045

Figure 7 - Heat pump deployment projection in 'Match Gas' pathway, Flintshire

Whilst this pathway is closer to achieving the targets, it still falls short of reaching the 2050 target. Assuming the firms installing gas boilers will also be the ones installing heat pumps, this suggests that current supply chain and workforce capacity will not be sufficient to achieve LAEP heat pump deployment targets. Note that the maximum rate increases to 4,200 units per year (almost 10 times the current heat pump deployment rate).

6.1.3 – Best-Case

In order to achieve the 2050 target with the lowest possible deployment rate, the 'Best-Case' pathway hits maximum rate by 2030 and starts mopping up remainders in 2045 – giving the LAs at least 15 years at the max deployment rate. Figure 8 demonstrates the rapid increase in deployment rate that is required to meet these conditions in Flintshire – an increase from 410 units per year in 2024 to 4,800 units per year in 2030, a period of 6 years. It should also be noted that this maximum deployment rate exceeds the calculated gas boiler replacement rate (4,200 units per year).

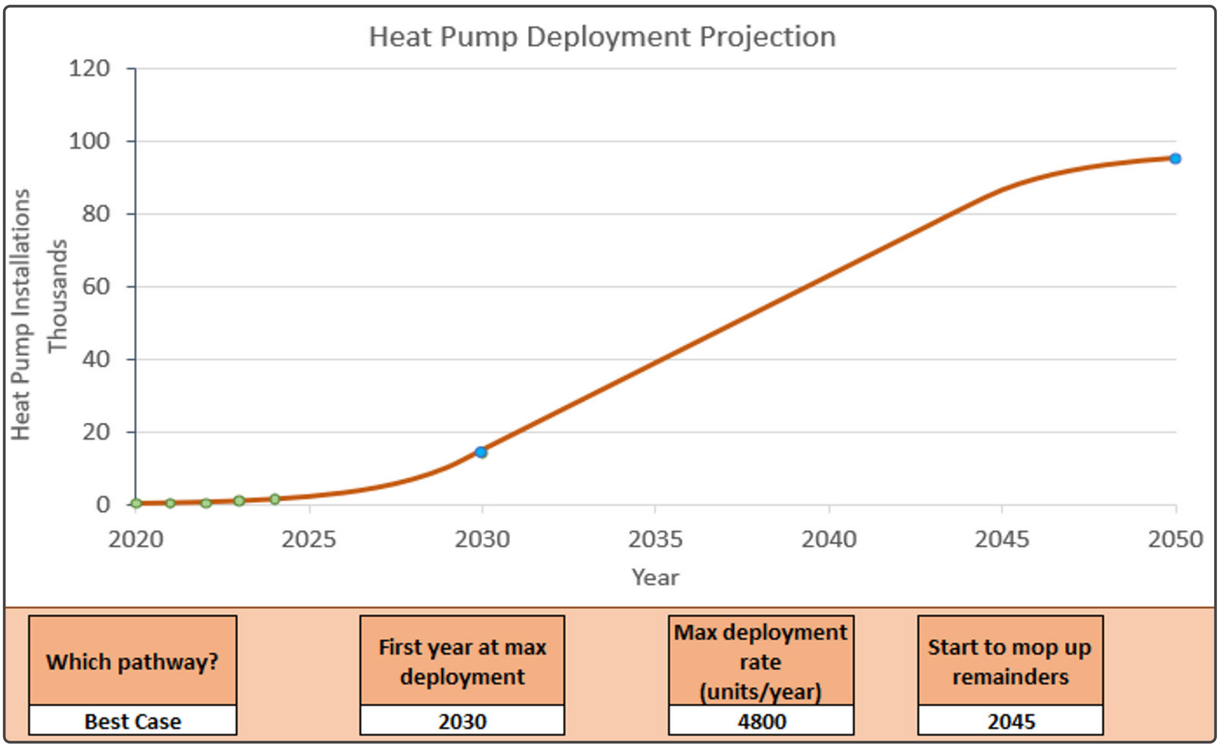


Figure 8 - Heat pump deployment projection in 'Best-Case' pathway, Flintshire

6.1.4 – Delayed Roll-Out

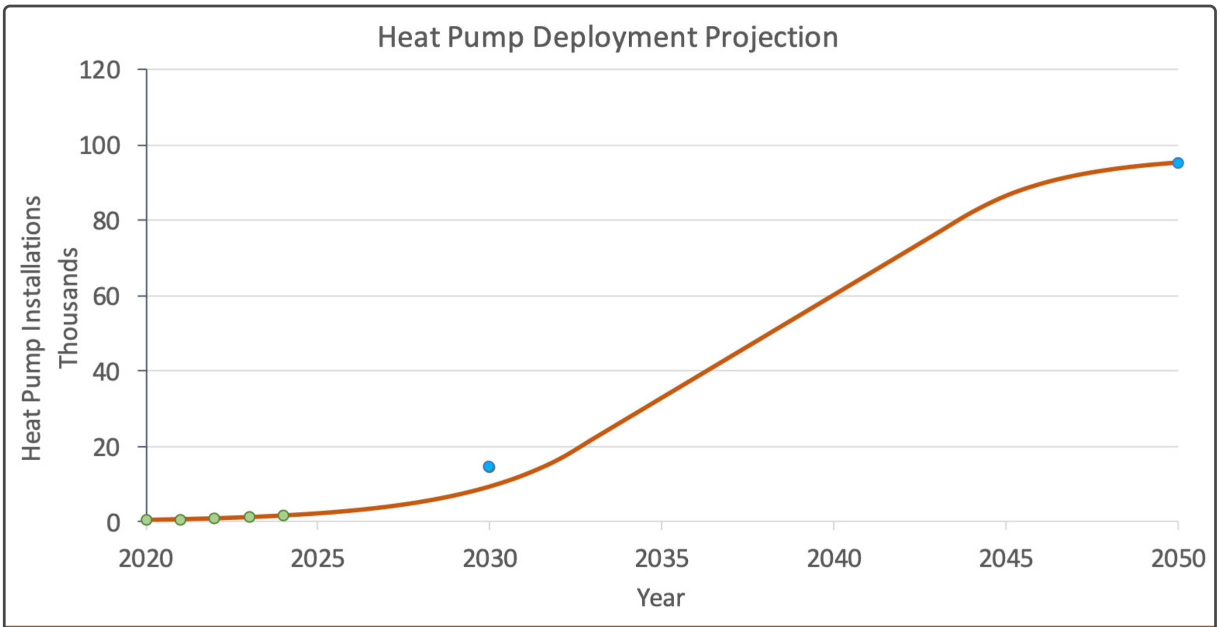
For some LAs, the 'Best-Case' pathway is too idealistic. In these cases, bounding the analysis to deliver the maximum deployment rate by 2030 was unrealistic. There was a need to create a pathway where the first year at maximum deployment was delayed, whilst still achieving 2050 targets.

The 'Best-Case' pathway was deemed 'credible' if the maximum installation rate was less than six times the 2024 installation rate. This benchmark assumes that an LA could scale up its deployment rate by its 2024 rate each year over a six-year period – a challenging but possible achievement. If the required 2030 rate exceeded this threshold, the 'Best-Case' pathway was considered unrealistic, and a 'Delayed Roll-Out' variant was introduced. In this pathway, the 'Initial Delay' depended on how many times greater the maximum installation rate was than the 2024 rate. Table 2 shows how many LAs had their projections adjusted in the 'Delayed Roll-Out' pathway.

Table 2 - Results from 'Best-Case' pathway credibility check

X-fold increase in deployment rate between current deployment rate and 'Best-Case' pathway	Number of LAs	First year at max deployment in 'Delayed Roll-Out' pathway
<6	6	2030
6-12	1	2032/2033
>12	11	2035

Figure 9 shows the 'Delayed Roll-Out' variant for Flintshire – by pushing the first year at maximum deployment back by three years, the rate of change is more gradual, and hence more realistic. As a consequence, however, the 2030 deployment target is missed, even though the 2050 target is still met.



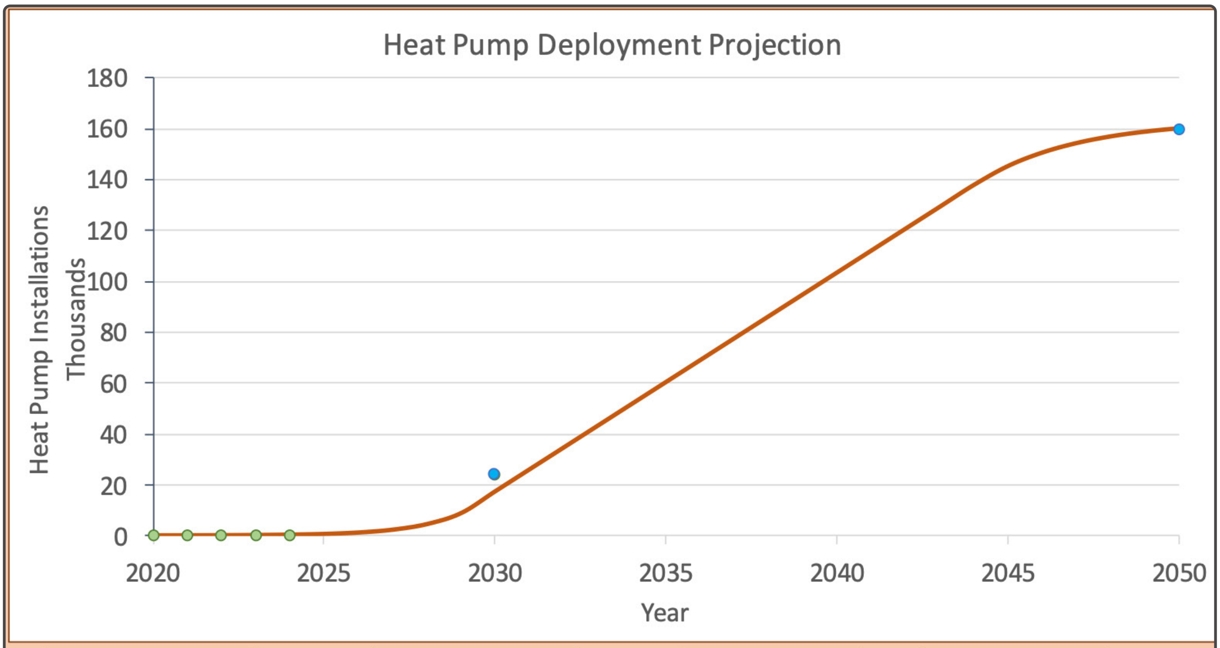
Which pathway?	First year at max deployment	Max deployment rate (units/year)	Start to mop up remainders
Delayed Roll-Out	2033	5500	2045

Figure 9 - Heat pump deployment projection in 'Delayed Roll-Out' pathway, Flintshire

The other caveat is that delaying the time taken to achieve maximum rate means less time at that rate. Therefore, in order to still achieve the 2050 target, the maximum deployment rate has to increase – from 4,800 units per year to 5,500. This helps to demonstrate that, if LAEP targets for 2050 are to be realised, any initial delay in heat pump deployment must be offset by an increase in the maximum deployment rate.

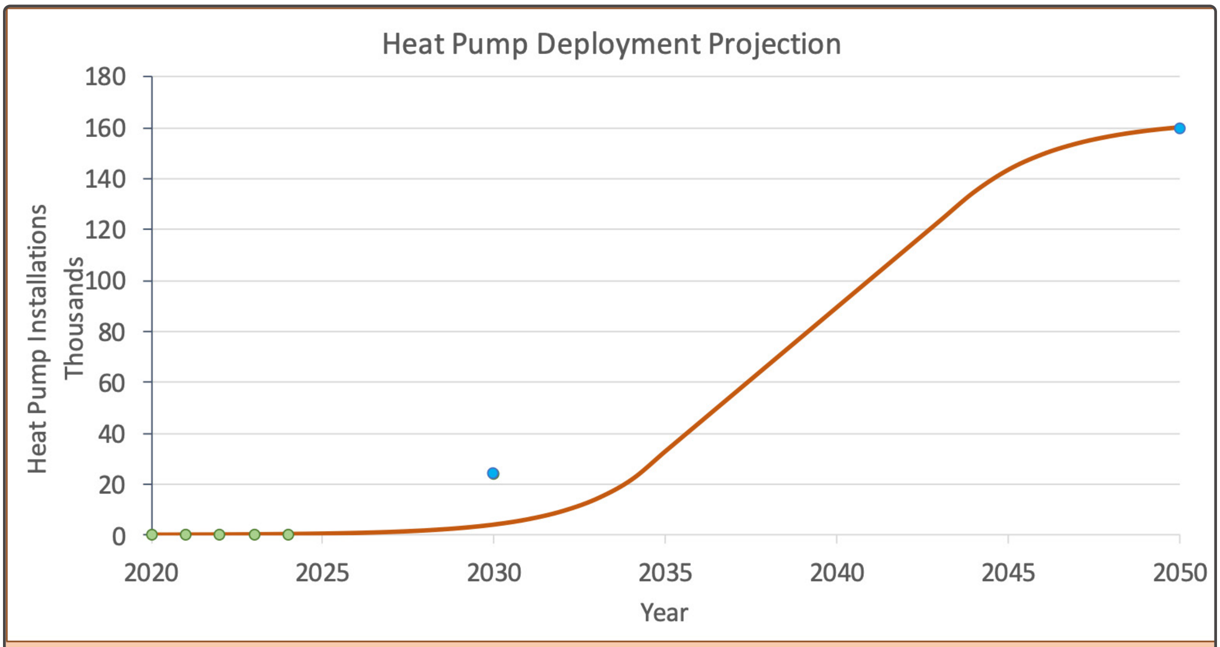
In other LAs, where the maximum deployment rate in the 'Best-Case' pathway was much higher than the current deployment rate, the differences in curve profile between the 'Best-Case' and 'Delayed Roll-Out' pathway were more pronounced than is shown in Figure 9. In such cases, the adjustment, which slows down initial deployment rates, causes the 2030 target to be missed by a significant amount, where previously, in the 'Best-Case' pathway, the target was either achieved or within a small margin of doing so.

Cardiff was one such LA, where the adoption profile varied significantly once the first year at maximum deployment had been delayed – see Figures 10 and 11. Note that the maximum deployment rate increases from 8,600 to 11,300 units per year.



Which pathway?	First year at max deployment	Max deployment rate (units/year)	Start to mop up remainders
Best Case	2030	8600	2045

Figure 10 - Heat pump deployment projection in 'Best-Case' pathway, Cardiff



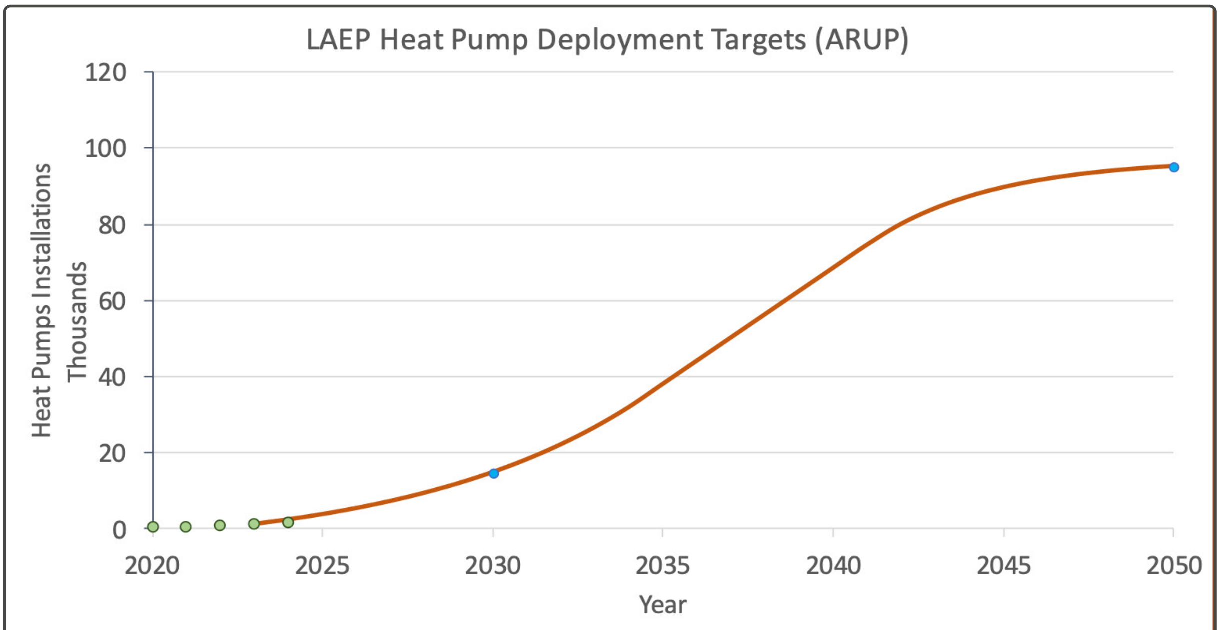
Which pathway?	First year at max deployment	Max deployment rate (units/year)	Start to mop up remainders
Delayed Roll-Out	2035	11300	2045

Figure 11 - Heat pump deployment projection in 'Delayed Roll-Out' pathway, Cardiff

6.1.5 – LAEP Projections

This pathway helps to visualise the LAEP projections from the three different consultancies. Figures 12, 13, and 15 show the LAEP projections for three different LAs.

- ***Arup projections***
  Starting with a baseline of 2023, Arup projections have a 2030 and 2050 target, hitting maximum rate between 2030-2035 and deployment rates start to level off around 2042. The projection profile can be seen in Figure 12 and is consistent with a rate of change graph featured in some of the Arup LAEPs (shown in Appendix B).



Which pathway?	First year at max deployment	Max deployment rate (units/year)	Start to mop up remainders
LAEP Projections	2035	6100	2042

Figure 12 - Heat pump projection in 'LAEP Projections' pathway, Flintshire - Arup

▷ *City Science projections*

Compared to the Arup LAEPs, City Science projections (which are displayed in Figure 13) start a lot slower, gradually building towards a maximum deployment rate which does not reduce before 2050. This trajectory does not follow an 'S' shape.

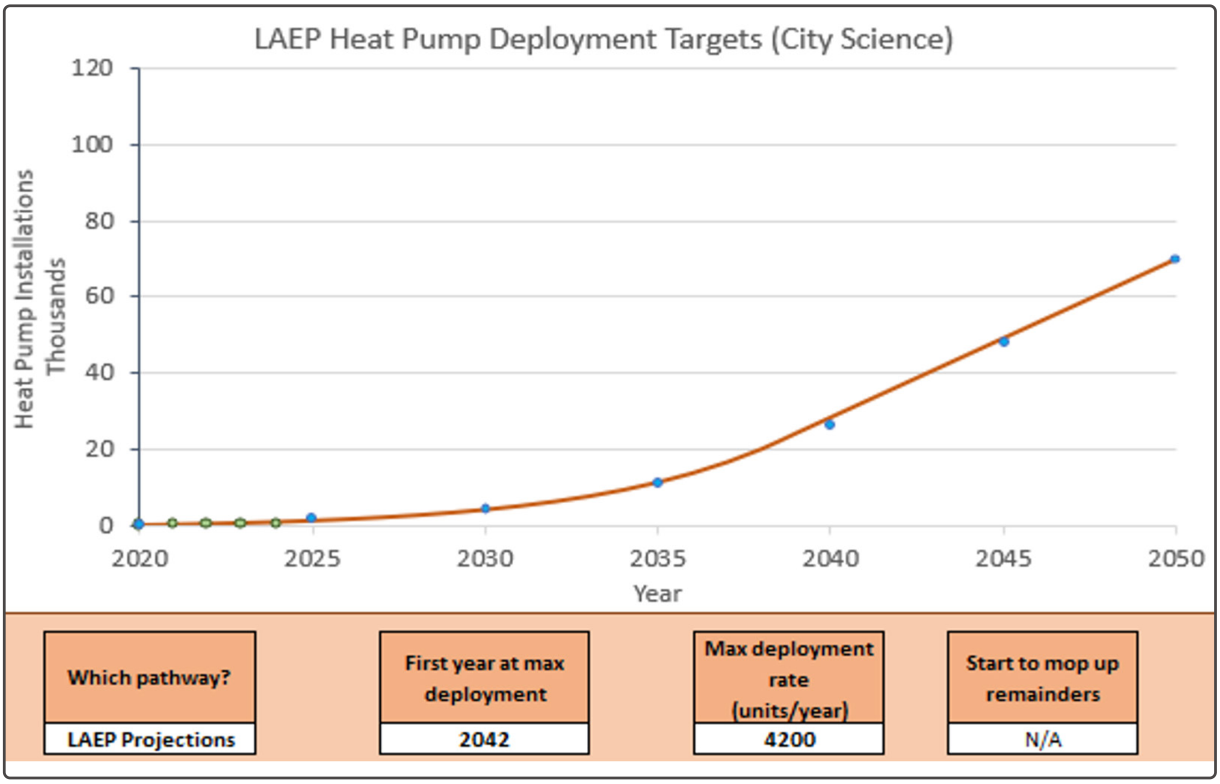


Figure 13 – Heat pump projection in 'LAEP Projections' pathway, Neath Port Talbot - City Science

▷ *ES Catapult projections*

The LAEPs produced by the ES Catapult are based on modelling that starts with a 2020 baseline, and predicts a development of heat pump deployment that does not follow an S-curve – as shown in Figure 14, taken from the Powys LAEP (Powys LAEP, 2024).

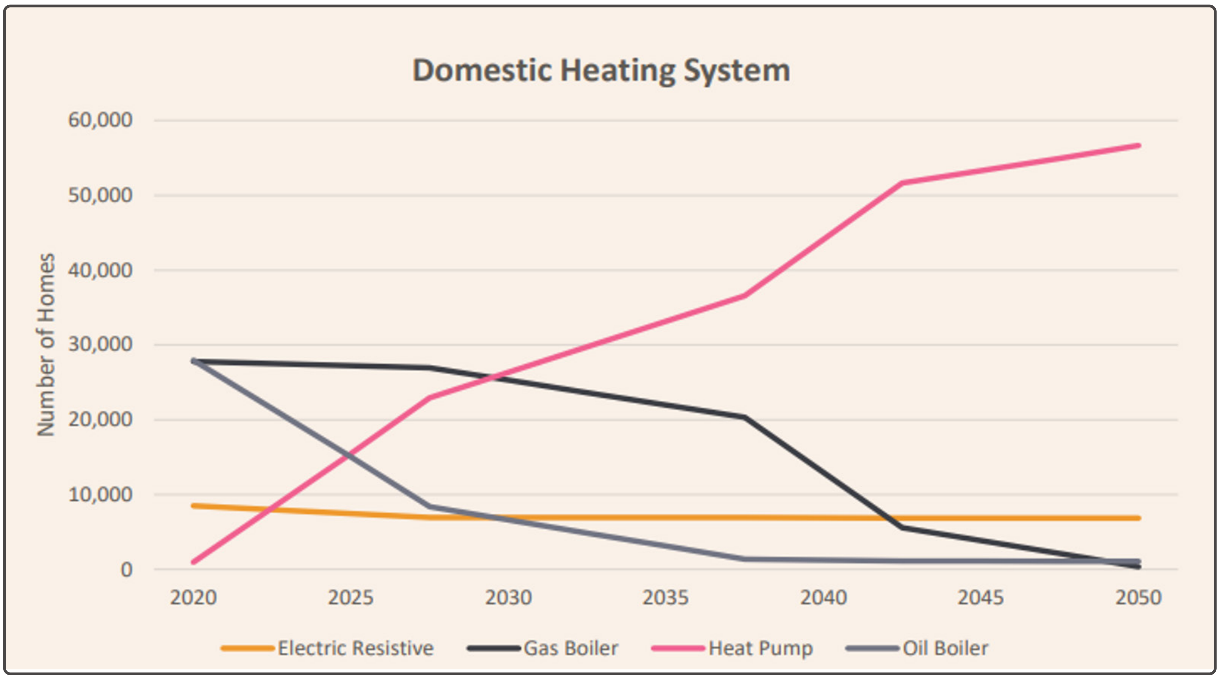


Figure 14 - ES Catapult domestic heating projections (Powys LAEP, 2023)

These projections cannot be replicated using the exponential growth-plateau-decay structure of the analysis used for this study, and a best-fit approach has been used (see Figure 15).

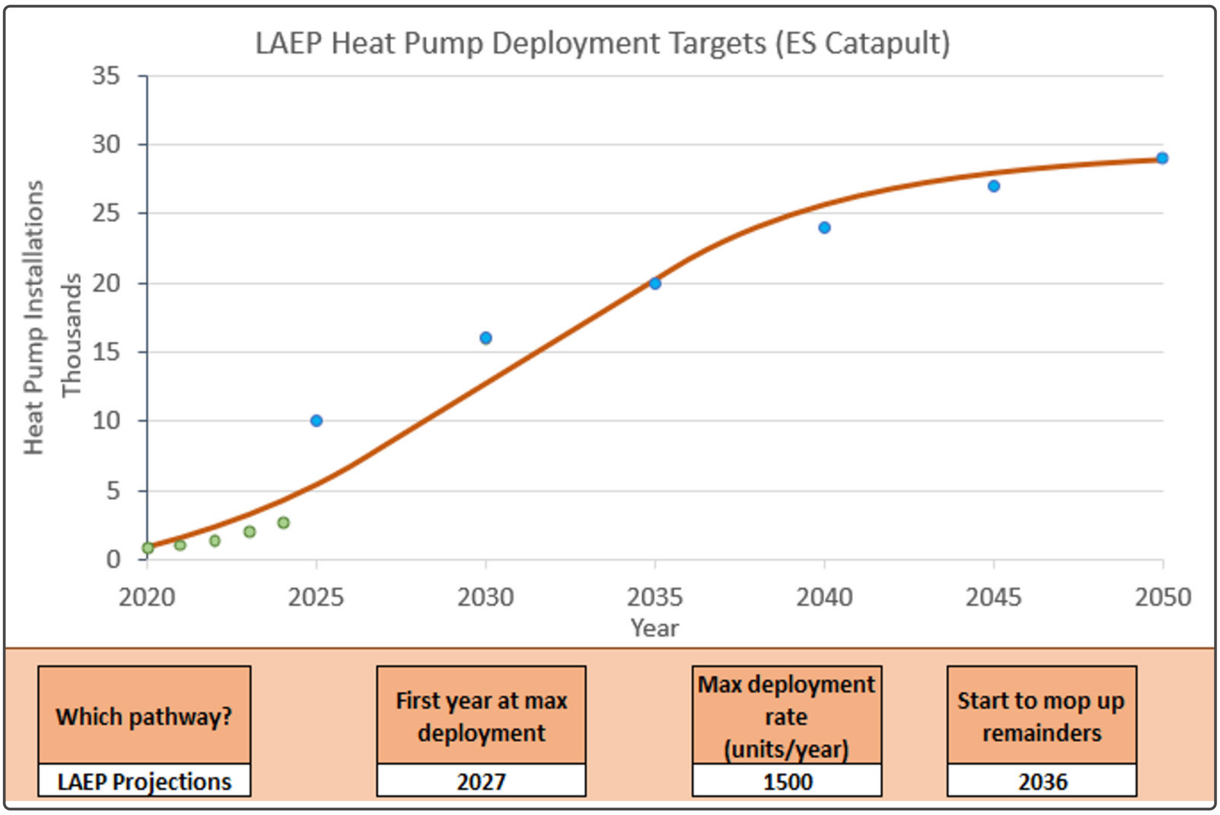


Figure 15 - ES Catapult domestic heating projections (Powys LAEP, 2023)

7 – Results

This section presents the results from the analysis. The outputs are grouped as follows:

- **7.1:** in this section the results from the 'No Improvement' and 'Match Gas' pathways are presented. Since these pathways are not designed to meet the 2050 target, they are useful to see how many LAs would fall short of their targets under certain conditions.

- **7.2:** since the 'Best-Case, 'Delayed Roll-Out', and 'LAEP Projections' pathways are defined to meet the 2050 targets, the focus is on the deployment rates required to accomplish this. This section therefore presents the roll-out rates from each of these pathways and compares them against those in the 'Match Gas' pathway, and UK-wide targets for heat pump deployment rates.

- **7.3:** in this section the impact that heat pump deployment has (in the 'Delayed Roll-Out' pathway) on total gas consumption is shown and compared to WWU's own forecasts.

Throughout this section, there are lots of references to the 'combined maximum deployment rate'; this is the cumulation of the maximum deployment rates for all 18 LAs in the analysis, in a particular pathway.

A reminder for how the maximum heat pump deployment rates are established for each pathway is given below:

- **'No Improvement':** the current rate of heat pump deployment

- **'Match Gas':** an estimation for the current gas boiler replacement rate

- **'Best-Case':** the lowest deployment rate that will achieve the 2050 target with at least 15 years at maximum deployment (2030-2045)

- **'Delayed Roll-Out':** the lowest deployment rate that will achieve the 2050 target with 10-15 years at maximum deployment (depending on whether first year at maximum deployment needed delaying due to poor historic performance against targets).

- **'LAEP Projections':** the rate required to create the closest fit possible to the LAEP target points

7.1 – Reference pathways: No Improvement and Match Gas

Table 3 shows what percentage of LAs would hit their 2030 and 2050 heat pump deployment targets in the 'No Improvement' and 'Match Gas' pathways, and the difference in the combined maximum deployment rate between the two.

Table 3 - Percentage of LAs that meet their 2030 and 2050 targets, and combined deployment rate

Pathway	Combined maximum deployment rate	Percentage of LAs that meet their 2030 target	Percentage of LAs that meet their 2050 target
No Improvement (current rate)	6,100	17%	0%
Match Gas	68,000	67%	56%

7.1.1 – No Improvement

In this pathway, where the heat pump deployment rate does not increase above current levels, only 17% of LAs achieve their 2030 deployment targets and none of the LAs meet their 2050 targets. That being said, this pathway is not expected to occur, since heat pump deployment rates are likely to increase between now and 2050, continuing the trend observed over the last five years.

7.1.2 – Match Gas

For the 'Match Gas' pathway to occur, the combined maximum deployment rate across all the LAEPs analysed has to increase more than ten-fold, from 6,100 per year to 69,000, by 2030. Should that happen, 67% of LAs would meet their 2030 targets, and 56% would achieve their 2050 targets. This is concerning because it means that in some areas heat pump deployment rates will have to increase beyond the estimated current gas boiler replacement rate if 2050 targets are to be achieved.

7.2 – Comparison of deployment rates

Table 4 presents the combined maximum deployment rates from the 18 LAEPs analysed for each pathway. These are shown alongside the UK-scaled deployment rates that would be required if similar heat pump roll-outs were to be delivered across the whole of the UK. It also indicates when these deployment rates would need to commence to allow the 2050 deployment targets to be achieved. For comparison, the table also includes the CCC's target heat pump deployment rates for 2030 and 2035, outlined in the Seventh Carbon Budget (CCC, 2025).

Table 4 – Combined and UK-scaled deployment rates for each pathway in the analysis, and heat pump deployment targets from CCC's Seventh Carbon Budget (CCC, 2025).

Pathway	Combined maximum deployment rate (heat pumps/year)	UK-scaled deployment rate (heat pumps/year)	Start year
CCC 2030 Target	-	450,000	2030
CCC 2035 Target	-	1,500,000	2035
No Improvement	61,000	160,000	2024
Match Gas (gas boiler replacement rate)	68,000	1,800,000	2030
Best-Case	61,000	1,600,000	2030
Delayed Roll-Out	74,000	2,000,000	2030-2035
LAEP Projections	71,000	1,900,000	2030-2035

Note that the combined maximum deployment rate for the 'Match Gas' pathway offers an estimation for the gas boiler replacement rate in Wales (less the four LAs not included in the analysis).

7.2.1 – Best-Case

Table 4 shows that, going from 'Match Gas' to 'Best-Case', the combined maximum deployment rate decreases from 68,000 to 61,000. This is because, while the deployment rate has to increase in some LAs to ensure they achieve their targets, it was decreased more significantly in other LAs who could reach their target using deployment rates below their respective gas boiler replacement rate. This suggests that heat pump targets across Wales can still be met at a combined rate which is below the gas boiler replacement rate. But that is only true as long as the suggested deployment rates are met by 2030.

Scaling up the target, offers an estimation for the rate that would be required if a similar level of deployment were to be achieved across the whole of the UK. This suggests that an equivalent UK-scaled roll-out would require 1,600,000 installations per year by 2030. This is significantly more than 450,000 installations per year targeted in the Seventh Carbon Budget for 2030.

7.2.2 – Delayed Roll-Out

A credibility analysis (outlined in Section 6.1.4) suggests that – for 67% of LAs – the 'Best-Case' pathway is unrealistic, due to the fact that the 'Best-Case' maximum deployment rate is far higher than the rate at which heat pumps are currently being deployed. Table 5 highlights the scale of the required ramp-up in deployment for those LAs in which the targets are the most ambitious.

Table 5 – Maximum heat pump deployment rate increases from current levels to 'Best-Case' pathway

Local Authority	Current heat pump deployment rate (as shown in 'No Improvement' pathway)	'Best-Case' maximum deployment rate	X-fold increase
Blaenau Gwent	50	1,500	30
Cardiff	100	8,600	86
Merthyr Tydfil	20	1,200	60
Rhondda Cynon Taf	90	4,200	47
Swansea	200	6,500	33

In total, 12 LAs had to have their 'Best-Case' pathway adjusted. As explained in Section 6.1.4, when the 'Delayed Roll-Out' variant is introduced, the first year at maximum deployment rate (in LAs where the 'Best-Case' pathway is deemed unrealistic) is delayed. This results in less time spent at the maximum deployment rate, which necessitates an increase to that rate. Table 6 pulls relevant data from Table 4, showing what impact delaying the first year at maximum deployment has on the combined maximum deployment rate and the UK-scaled deployment rate.

Table 6 – Differences in combined, and UK-scaled maximum deployment rates across 'Match Gas', 'Best-Case and 'Delayed Roll-Out' pathways.

Deployment rate form	Match Gas (gas boiler replacement rate)	Best-Case	Delayed Roll-Out
Combined maximum deployment rate	68,000	61,000	74,000
UK-scaled deployment rate	1,800,000	1,600,000	2,000,000

Going from the 'Best-Case' to the 'Delayed Roll-Out' pathway, the combined maximum deployment rate increases by 13,000 – taking the figure 6,000 above the gas boiler replacement rate – while the UK-scaled value rises to 2,000,000 annual installations. This increase in the UK-scaled deployment rate, takes it 500,000 above the CCC's 2035 target (of 1,500,000; as detailed in Table 4). As a result, even the 'Delayed Roll-Out' pathway may not be achievable, as the maximum deployment rates increase further beyond current supply chain and workforce capacity and diverge significantly from UK-wide aspirations.

7.2.3 – LAEP Projections

The figures for the 'LAEP Projections' pathway have been pulled from Table 4 and are displayed in Table 7.

Table 7 - Combined and UK-scaled maximum deployment rates for 'LAEP Projections' pathway.

Deployment rate form	LAEP Projections
Combined maximum deployment rate	71,000
UK-scaled deployment rate	1,900,000

The combined and UK-scaled deployment rates for the 'LAEP Projections' pathway are slightly lower than in the 'Delayed Roll-Out' pathway but are still higher than the gas boiler replacement rate and the CCC's targeted installation rate by 2035, respectively. This is concerning when considering what is suggested in Figure 1 (Section 3), that actual heat pump installations across Wales, in 2024, are already behind where they should be to meet 2030 targets. This suggests that future deployment rates will have to increase to compensate, creating additional delivery challenges.

7.3 – Impact on the gas network

Figure 16 shows how the predicted impact on total gas demand, in the 'Delayed Roll-Out' pathway, compares with the forecast from WWU's 2024 'Long Term Development Strategy' (WWU, 2024). Note the annual gas consumption (y-axis) figures have been redacted to respect data privacy.

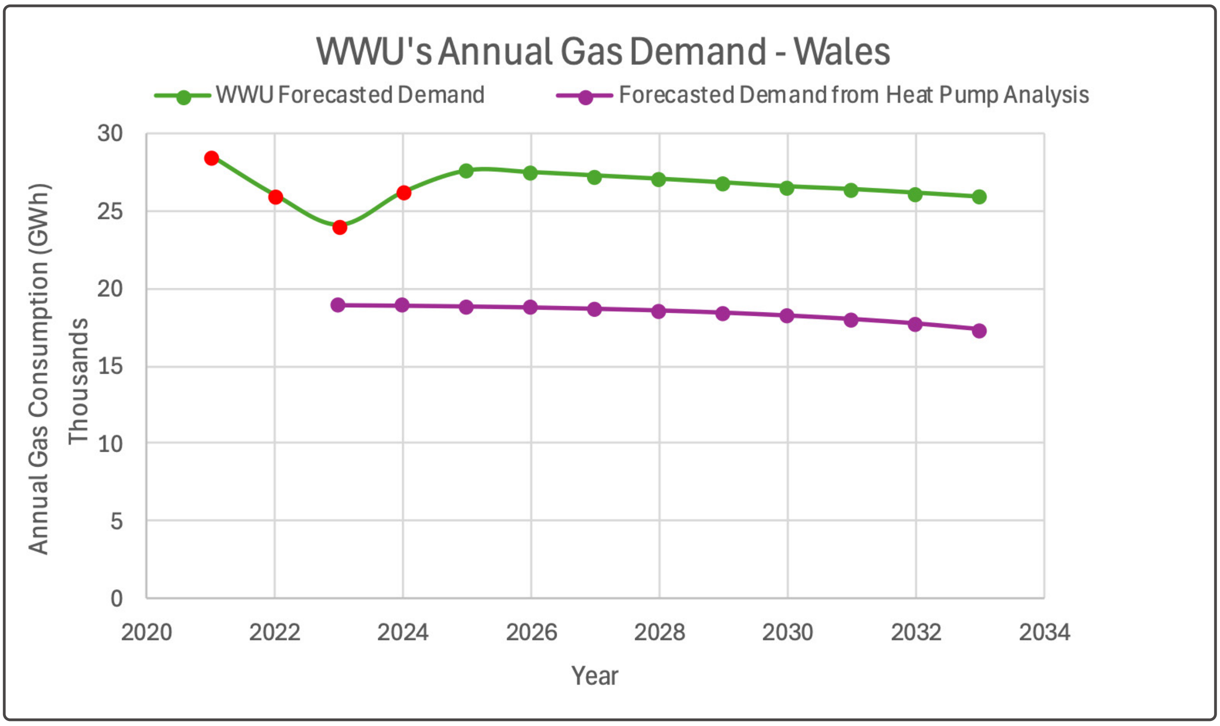


Figure 16 - Comparison of WWU forecasted gas demand (WWU, 2024) with the predicated gas demand from the heat pump analysis from 2023-2033 (taken as a cumulation of all LAs gas demands in the 'Delayed Roll-Out' pathway).

The two lines start at different points because WWU's forecasted demand is for the whole of Wales, whereas the purple line is only for the 18 LAs included in the analysis. In this context however, the absolute figures are redundant as the trends are the focus of the analysis.

WWU predict gas demand to increase through to 2025 (recovering losses which came as a result of the gas-price-hike) before starting a very gradual decline through to 2033 – although not dropping below the 2023 level at any point. Ignoring the increase from 2023-2025, as this is not something that could be predicted from the analysis carried out for this report, a similar trend is observed from calculating the impact of heat pump roll-out on gas consumption across the 18 LAs considered.

Figure 17 shows the potential impact of heat pump deployment on gas demand beyond 2033 (if heat pump deployment follows the 'Delayed Roll-Out' pathway). The findings from this analysis suggest that heat pump deployment will start to have an increasingly significant impact around 2032/33, just as WWU's forecast finishes. This reflects the sharp increases in heat pump deployment as LAs reach their maximum deployment rates between 2030 and 2035 in the 'Delayed Roll-Out' pathway.

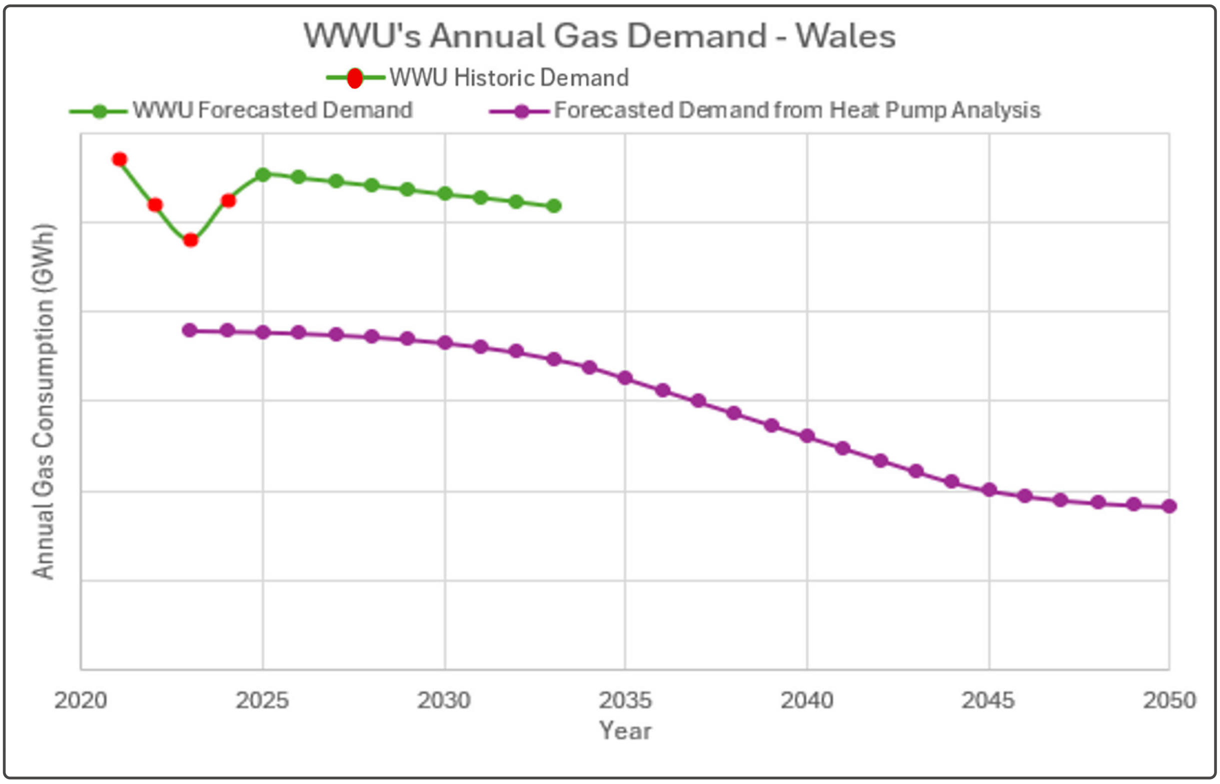


Figure 17 - Comparison of WWU Forecasted Gas Demand with the predicated gas demand from the heat pump analysis from 2023-2050 (taken as a cumulation of all LAs gas demands in the 'Delayed Roll-Out' pathway.

8 – Discussion

8.1 – Summary of key findings

This section summarises the main insights from the analysis:

1. **Current trajectories fall short** – if the heat pump deployment carries on at its current rate none of the LAs will meet their 2050 target. This stresses a need for policy and market intervention to deliver the scale of roll-out required.

2. **Supply chain constraints** – even if heat pumps are installed at the same rate that gas boilers are currently replaced, just under half of the LAs in the analysis don't reach their 2050 targets. This suggests that many LAEP targets rely on roll-out levels that exceed current local supply chain and workforce capacity.

3. **Deployment rates are as important as absolute targets** – absolute targets for heat pump deployment fail to convey the true scale of the challenge, as they are time-distant and abstract. By detailing the deployment rates required to achieve these targets, it is easier to understand where the key challenges lie.

4. **Deployment rates** – the analysis showed that making heat pump targets more achievable requires significant improvements in deployment rates (the number of heat pumps installed each year). In most cases, achieving the targets set for 2050, requires maximum deployment rates to be achieved and sustained from 2030 onwards. Any delay to this, increases the number of installations required each year if the 2050 targets are still to be met. However, for 12 of the 18 LAs analysed, meeting maximum installation rate by 2030 appears unrealistic, because doing so requires such significant increases from current levels of deployment.

5. **Replacement rate** – if the heat pump deployment is to be sustainable, installation rates need to align with natural replacement cycles so that, once the market matures, the deployment rate merges into a replacement rate. However, the longer progress towards deployment targets is delayed, the more likely it becomes that roll-out rates will need to exceed sustainable replacements levels to meet 2050 targets. The greater the gap between deployment and replacement rates, the harder it will be to manage the transition sustainably, as, once the market is saturated, supply chains and the workforce will have to contract in line with reduced demand.

6. **Disparity between national and local targets** – in the analysis reported here, if the deployment rates required for LAs to meet their heat pump deployment targets, were repeated across the whole of the UK, deployment rates would need to be well above the CCC target of 1,500,000 installations per year by 2035. If roll-out rate was to follow the CCC's trajectory, then the heat pump deployment targets in the LAEPs analysed would be missed in most cases. Considering this alongside the other findings, suggests that, in most cases, the heat pump deployment targets in the LAEPs reviewed are too high.

7. **Transitional considerations** – total gas consumption is predicted to follow the inverse of the 'S-curve' that has been used to project heat pump deployment in this analysis. If heat pump deployment trends toward maximum rates by 2035, gas boiler disconnections will start occurring at much faster rates, resulting in precipitous decreases in gas demand.

8.2 – Implications

8.2.1 – Disparity between national and local targets

In the three pathways where all LAs meet their deployment targets – 'Best-Case', 'Delayed Roll-Out', and 'LAEP Projections' – the UK-scaled maximum deployment rate is above that targeted by the CCC for 2035, of 1,500,000 installations. This finding points to one of two possibilities:

1. The roll-out suggested by the CCC is too low
2. The heat pump deployment targets, in the majority of LAEPs analysed, are too high

It is hard to know which one is valid, as the Seventh Carbon Budget does not include a figure for the targeted number of heat pump installations by 2050, it only states "All new and replacement heating systems become low carbon after 2035 to ensure a fully decarbonised housing stock by 2050." It could be, however, that the CCC are anticipating heat pump uptake to be less widespread than it is in the LAEPs, given that many of the deployment targets in the LAEPs are for scenarios where heat demand is largely electrified.

Either way, this analysis has demonstrated that there is a distinct disparity between the rates required to meet LAEP targets and those outlined by the CCC in the Seventh Carbon Budget. The findings suggest that, if the roll-out rate was to follow the CCC's trajectory, then the heat pump deployment targets, in the majority of the LAEPs analysed, would be missed. In addition, the recent revision of the Energy Security Bill's target of 600,000 installations per year by 2028 (UK Government, 2022) to 450,000 by 2030, is a reminder that UK installation targets are far from guaranteed.

8.2.2 – Replacement rate

In this analysis, the gas boiler replacement rate has been referred to frequently because it is the only available reference point for practical heating system installation rates. Any heat pump deployment rate that rises above the gas boiler replacement rate (see Section 8.3.2 for the limitations of this figure) should be questioned – especially given the longer installation times being experienced for heat pumps (of around five days; British Gas, 2025) – because achieving these rates exceeds current supply chain and workforce capacity. This problem is especially acute in scenarios where the maximum deployment rate needs to be hit by 2030, particularly considering that a decision on hydrogen for domestic heating is unlikely to come before 2026. Until then, it is likely there will not be enough certainty for significant numbers of installers to transition to heat pump work, or for companies to start establishing firm supply chains.

When considering these implications, it is also necessary to consider the pace of the retrofit programme that has to precede heat pump deployment. The five-day installation period that many companies quote for a heat pump, assumes that the house is 'heat pump ready' and there aren't any problems with the installation (Hayles, 2024). This means the practicalities and costs of the preparatory work that is required, are often overlooked in discussions about heat pump deployment. In fact, particularly in homes where the Energy Performance Certificate (EPC) rating is below a C (the level required for heat pump installation), the process starts months before, with a consultation on what scale of retrofit is required to make the house heat pump ready (Octopus Energy, 2023), and can end up finishing weeks after the installation, as a result of an extensive process of fine tuning the system. When this is compared to the time allocated to a gas boiler installation – of one to three days (British Gas, 2019), irrespective of the condition of the home – it paints a picture of the scale of the resource required for widespread heat pump adoption. In doing so, it reinforces the gas boiler replacement rate as a generous proxy for what is achievable for heat pump deployment.

That being said, a distinction needs to be drawn between the gas boiler replacement rate and the heat pump deployment rate. Current gas boiler installation rates are generally associated with replacement of equipment in a well-established market, with known and sustainable supply chains. Heat pump installation on the other hand, is a nascent market with a lot of uncertainties about uptake and subsequent maintenance and replacement requirements. Consequently, comparing heat pump deployment rates with gas boiler replacement rates raises questions around market sustainability and whether firms and individuals, currently involved in gas boiler replacements, will join the heat pump supply chain, or whether other short to medium-term supply chain solutions will need to be found. Granted, the heat pump replacement rate is currently undetermined, but all the assumptions point toward it being lower than the gas boiler replacement rate since, on average, heat pumps are expected to have a longer lifespan – 15-18 years (IEA, 2025), compared to 10-15 years for a gas boiler (Worcester Bosch, 2025). In the long-term this will result in lower replacement rates for heat pumps than those currently experienced for gas boilers. Whilst this could have benefits for consumers and embedded emissions, it would also require a smaller supply chain and workforce in the long-term.

In situations where heat pumps are deployed faster than they will need to be replaced, issues surrounding workforce and supply chain constraints re-emerge because the high demand for installers is only temporary. When demand subsides, what happens to the workforce and the supply chains that have been established to facilitate higher deployment rates? This analysis has shown that one way to keep deployment rates as sustainable as possible is to accelerate progress immediately and achieve maximum deployment as early as possible.

In the Seventh Carbon Budget, the CCC state that '[heat pump] installation rates do not exceed natural replacement cycles', which indicates that they have considered this issue in the development of their 2030 and 2035 deployment rate targets (CCC, 2025). Exactly what they consider the replacement rate to be however, is unclear. If it is the 1.5 million units per year that is targeted for the 2035 deployment rate (CCC, 2025), then the analysis reported here suggests that, for LAEP targets to be realised, heat pump deployment rates will need to exceed natural replacement cycles.

Whilst accelerated roll-outs are not uncommon in technology transitions, it is important to recognise that the greater the discrepancy between the roll-out rate and the replacement rate, the more difficult it will be to manage the transition sustainably. Bihan et al. (2025) explored this issue by analysing how deployment rates have progressed for solar and wind technologies. They reported that, when deployment rates exceed replacement rates, production overshoots and the deployment rates oscillate due to successive installation and replacement cycles, instead of smoothly merging into a replacement rate as is reported when deployment is better controlled. They attribute these oscillations to ambitious energy targets, which result in successive periods of overproduction and underproduction, and have a negative impact on industrial stability. They go on to identify the shift from an adoption rate to a replacement rate as something that is "...crucial for ensuring the resilience and sustainability of renewable energy systems beyond 2050" (Bihan et al., 2025).

8.2.3 – Gas Distribution Networks (GDNs)

▷ *How do LAEPs impact GDNs' forecasts?*

LAEP heat pump deployment targets are a product of broad system modelling and the plans themselves are aspirational, unenforceable, and, as this analysis has shown, may not be achievable. GDNs, on the other hand, make their forecasts by exhaustively modelling data from hundreds of thousands of meter points (depending on the size of the network), in weather-sensitive demand models (WWU, 2023). This forecasting approach is highly robust and is a key part of ensuring they conform to the licence conditions that govern their operations. Since LAEPs do not face the same consequences, they can afford to be speculative and aspirational. Consequently, their influence on gas network forecasts is limited, as GDNs cannot risk basing their projections on aspirational targets.

Of the aforementioned licence conditions, perhaps the most important one to understand is an obligation to ensure that the gas network is prepared for 1-in-20-year weather conditions. This is in place to protect households from extreme weather, by ensuring that there's enough gas to supply consumers should a 1-in-20 weather event occur. If a GDN failed to deliver on this condition, the consequences are severe, both for the consumers and for them as a network operator; they could face licence revocation. GDN forecasts must therefore reflect this licence condition, limiting the impact of LAEPs, especially if the aspirations infringe on adherence to their licence agreements. This will remain the case so long as GDNs are bound by that regulation.

Given the consistency between the projections of gas consumption as a consequence of heat pump deployment in the 'Delayed Roll-Out' pathway, and those forecast by WWU (Figure 14), it would be interesting to know whether LAEPs influenced the forecasts at all, even if only to serve as evidence of future domestic heat electrification. Whilst there is no definitive mention of this being the case, in their 2024 'Long Term Development Strategy' WWU state: "In recent years we have worked directly on nineteen Local Area Energy Plans (LAEPs), supported by seventy runs of our bespoke 'Pathfinder' energy systems model to test alternative scenarios. We expect this activity to continue and grow in importance in the coming years…" (WWU, 2024). Hence, this indicates a positive response by this GDN to the LAEP process.

▷ *What does influence GDN forecasts?*

Utilising quotes from WWU's 'Long Term Development Statements', and other relevant documents, helps to offer an indication of what, if not LAEPs, inform network plans and forecasts. In contrast to WWU's 2024 forecast (Figure 14), which shows a gradual decline in gas consumption from 2025-2033, their previous (2023) Long Term Development Statement states: "Following this initial decrease and recovery, we have forecast that demand will increase from 2025/26 out to 2032/33 for all LDZs [local distribution zones]. This is primarily due to new connections of domestic customers and smaller loads, along with flexible generation and CNG [compressed natural gas] fuelling" (WWW, 2023). To explain why the steady increase in the 2023 forecast, between 2025/26-2032/33, flipped to a steady decrease in the 2024 forecast, WWU state that it is "…due to domestic heat demand being electrified" which is "consistent with counterfactual data from NG-ESO [National Grid – Energy System Operator (NESO)]" (WWU, 2024).

NESO's counterfactual scenario – published in their Future Energy Scenarios (FES) report (NESO, 2023) – is most consistent with the 'No Improvement' pathway in this analysis, where none of the LAs meet their 2050 heat pump deployment target. This recommended adherence to the counterfactual scenario originates from Ofgem's RIIO-3 framework document, which instructed GDNs to base their draft RIIO-GD3 document on the FES' 2023 'Falling Short' scenario – a scenario that does not achieve net zero.

In the framework for the development of the final RIIO-GD3 business plans however, Ofgem directs GDNs to show "...the impact of different FES 2024 pathways on their business plans" and ensure they include a sensitivity analysis that "...should, as a minimum, show the impact on plans between the Holistic Transition pathway and [the] Counterfactual..." (Ofgem, 2024). The inclusion of the 'Holistic Transition' pathway stipulates the recognition of a net zero compliant scenario, which is a positive. However, this appears to make little difference to the shaping of WWU's five-year plan, given that, prior to the publication of Ofgem's framework for RIIO-3, WWU stated in a consultation response, there is "...very low impact of FES scenarios on gas network investment in RIIO-3..." (WWU, n.d.).

All this is significant because forecasts and business plans reflect both the networks' and Ofgem's interpretation of how quickly heat network decarbonisation is likely to progress. If a GDN is partly basing its ten-year forecast on the FES net-zero non-compliant scenario and also states that the FES scenarios that are used to inform the business planning process have a very low impact on gas network investment by 2031, then this illustrates that both WWU, and Ofgem, do not anticipate the short-term uptake of renewable heating technologies to have any significant impact on the network. This is consistent with the findings from the analysis reported here: that gas demand will not drop significantly over the next decade, meaning that in the short-term gas networks will stay largely unchanged.

▷ *When will GDNs have to start reacting to LAEPs?*

The analysis reported here has shown that, if LAEP targets are to be met, the crucial point will occur in the next price control period (from 2031-2036), when heat pump deployment would need to be reaching its maximum rate. This is when gas boiler disconnections, as a consequence of heat pump roll-out, start to have a tangible impact on gas consumption.

Given the outlined rigidity of the RIIO framework (Section 2.4.2), it therefore seems imperative that if LAEP targets are to be met, then an anticipation of widespread heat pump deployment needs to be reflected in the RIIO-4 framework. If, however, the RIIO-4 framework instructs the gas network to continue business as usual, and the framework is constructed according to assumptions that the network continues at current capacity, then this could mean one of two things:

1. **LAEP targets will be very difficult to achieve** – if real progress on heat pump deployment is not anticipated until after 2036, then this analysis suggests that widespread adoption of heat pumps as the solution to domestic heat decarbonisation will not be feasible within the limits of the supply chain and workforce capacity. Consequently, other means of decarbonising heat networks will have to be sought, if they are to be decarbonised by 2050.

2. **The gas network risks becoming uneconomical to operate** – if heat pump deployment does proceed as required to meet LAEP targets, and Ofgem doesn't make anticipatory changes to the price control framework and/or GDNs' licence agreements, then gas networks will have to socialise their costs across a rapidly declining client base, which can only be commercially viable for so long.

Either way, the framework for the next price control period will act as a statement, from Ofgem, as to how realistic they consider the heat pump deployment targets, as set out in the LAEPs. If the framework mirrors much of what is laid out in RIIO-3, then there should be serious concerns that heat network decarbonisation is not occurring fast enough, or, if progress does accelerate, that GDNs won't have enough leverage to deal with the rate of change.

How does heat pump deployment threaten GDN business models?

One of the issues threatening GDNs is how they socialise their costs as the number of gas consumers reduce. This creates a conflict between implementation of the LAEPs and the operational realities of GDNs. Currently, due to their licence agreements, GDNs are required to "…maintain an efficient and economical pipeline system for the conveyance of gas" and comply "…so far as it is economical to do so, with any request… to connect to that system, and convey gas by means of that system to, any premises" (Gas Act, 1986a), ensuring that "…where any premises are connected, the gas transporter shall maintain the connection until such time as is no longer required by the owner or the occupier of the premises" (Gas Act, 1986b). Therefore, a reduced consumer base does not necessarily translate to a reduced service, because as their consumer base declines, GDNs will still need to maintain most of their network for some time. Under these conditions, it's difficult to see how GDNs can continue operating in an "efficient and economic" way, without burdening the remaining customer base with disproportionately high costs.

Unfortunately, GDNs' forecasting methods do not lend themselves to dealing with this issue. By virtue of being data driven and having to comply with licence agreements, their forecasts are reactive; they have to witness a reduction in gas demand before they can respond to it. This problem is only exacerbated by the issues highlighted in this analysis: slow progress toward heat pump targets now, necessitates higher deployment rates later on. The higher the rate of heat pump deployment, and the more locationally uncoordinated it is, the harder it will be for gas networks to manage. One way of handling this uncertainty, would be to switch from data-based to more scenario-based forecasting, but exactly how this is done, under existing licence conditions, is unclear.

Alternatively, older iterations of LAEPs, like that produced for Bridgend, use heat zoning – allocating whole areas of households to a specific heating technology, such as heat pumps or district heating – as the solution for decarbonising domestic heat (Bridgend County Borough Council, 2021). This is a good way of mitigating the struggles of a diminishing consumer base, because it means heat pump deployment is organised onto specific areas – allowing GDNs to decommission whole sections of the network. If managed in this way, network costs can fall in parallel with increasing electrification, as the network contracts and redundant assets are either decommissioned, or where possible, liquidated.

Heat zoning however, has not been included in the latest iterations of LAEPs, at least not in Wales. While it is not clear why, it could be because, under current licence conditions, heat zoning is not possible. Gas networks do not have the authority to decommission sections of the network, unless it has become obsolete, or they have consumer approval. For heat zones to work, licence conditions would have to change, and consumers would have to relinquish their freedom to choose what central heating technology they want.

8.2.4 – Electricity Distribution Network Operator (DNO)

From the DNO's perspective, current electricity distribution capacity will act as a constraint to the widespread adoption of heat pumps. To accommodate this, they will need to reinforce and expand their networks – a capital-intensive process that often requires long lead times, careful forecasting, and regulatory approval. This is easier to plan for if heat pump deployment follows a moderate, predictable increase, that provides the grounding for a reliable forecast.

This analysis has highlighted however, that if targets are to be met, heat pump deployment seems likely to continue gradually, before sharply increasing. It has also shown – through comparisons with CCC targets and gas boiler replacement rates – that the higher the deployment rates have to get to meet 2050 targets, the more unrealistic they become. This places DNOs in a difficult position of having to plan their network to accommodate deployment targets which may not happen, potentially leaving them with stranded assets and unrecoverable costs. The alternative however, to under-build, risks grid constraints, which could violate their licence agreements, and lead to customer dissatisfaction.

These issues become even more complex when considering how DNOs will have to build in the flexibility to handle peak demands in the winter.

8.2.5 – Energy planning

The analysis reported here has shown that slow progress in the early stages of technology deployment has a potentially instrumental impact on the achievability of deployment targets. This helps highlight one of the key issues with contemporary energy planning: the consequences of slow progress are understated. New iterations of energy plans/forecasts (such as Future Energy Scenarios or Distribution Energy Scenarios) reset the projections each year to ensure that 2050 targets are still met – regardless of historic performance. When this happens, future installation rates are subtly increased, in many cases, beyond levels that are practically achievable. This is done to ensure that plans meet their licence conditions and remain net-zero compliant. This does not mean however, that they also undergo rigorous credibility checks and, as a result, they do not necessarily present deployment rates that are actually achievable. In the next iteration of the LAEPs, if the deployment targets are to remain the same and actual heat pump deployment continues on its current trajectory, the future deployment rates will have to be significantly higher than they currently are, which will make them increasingly unrealistic.

Approaching energy planning in this way, is counterproductive, because following false illusions stunts progress towards finding practical solutions. Instead, energy planning authorities could be identifying what is actually achievable, monitoring progress against these limits, and exploring alternative methods of reaching net zero goals as it is clear that the ambitions are not realistic.

8.3 – Limitations

Whilst this analysis has offered some interesting insights into the feasibility of LAEP heat pump targets, and explored some of the implications these plans have, it is not without its limitations.

8.3.1 – Inclusion of non-domestic installations

The inconsistency of target data in the LAEPs between the different consultancies, meant that, when totalling and scaling maximum deployment rates for each pathway, different types of data had to be combined. Unfortunately, there was no way around this, because Arup LAEP targets included non-domestic installations whereas the others did not. It was assumed that non-domestic installations were insignificant in comparison to domestic installations and hence they were ignored.

This limitation reduces the confidence in comparisons made with total figures. Having consistent data across all LAEPs would enable better aggregation and subsequent comparison with national targets.

8.3.2 – Gas boiler replacement rate calculation

For each LA, the gas boiler replacement rate (the maximum rate in the 'Match Gas' pathway) was calculated by apportioning the UK's domestic gas boiler replacement rate to each LA, according to the number of domestic gas boilers in their jurisdiction. For LAs whose targets include non-domestic installations (Arup LAEPs), the rate is therefore lower than it should be because it is based on domestic gas boiler installations and therefore omits non-domestic installations. The higher the number of non-domestic installations in an LAs deployment target, the less accurate the gas boiler replacement rate will be as a representation of workforce and supply chain capacity. This limitation is evident in two LAs (each with Arup LAEPs), where the current heat pump deployment rate is already above the calculated gas boiler replacement rate. Consequently, comparisons with the 'Match Gas' pathway or the gas boiler replacement rate may result in misleading conclusions about feasibility. If all LAEPs separated domestic and non-domestic installations (like City Science do), this would be less of an issue.

8.3.3 – S-curve

The analysis for this report assumed an 'S'-shaped trajectory for heat pump deployments, in line with CCC predictions and historical adoption patterns of other renewable technologies. Divergence from the S-curve, however, could undermine the accuracy of the analysis. This uncertainty highlights the importance of ongoing data collection and dynamic planning to ensure that deployment strategies remain responsive to real-world developments.

8.4 – Recommendations

The first section of the recommendations will offer ways in which the LAEP process could be improved. Whilst LAEPs have been the centre of this analysis, most of the recommendations are relevant across the whole systems energy planning landscape. With RESPs in mind, the second section will offer more generic ways in which energy planning would need to change, if energy plans are to become more directive – as the licence agreement between NESO and Ofgem suggest they will be (Ofgem, 2024).

8.4.1 – Recommendations for later iterations of LAEPs

1. **More diverse solutions to heat network decarbonisation –** having widespread adoption of heat pumps as an option for heat network decarbonisation provides an informative and useful upper bound for heat pump deployment targets. It would benefit, however, by being supplemented with a more diverse range of heat decarbonisation scenarios. These scenarios could offer alternative approaches (with less reliance on heat pumps) that could be adopted when it is clear that heat pump roll-out is not progressing as expected. Whilst it is recognised that some LAEPs already do this, it could become standard across all LAEPs, and they could offer scenarios that are more holistic than an alternative route that meets all heat demand with hydrogen.

2. **LAEPs need to be clearer on what their targets represent –** for the decarbonisation of domestic heating, LAEPs could contain specific deployment targets for each scenario, which would give LAs a clearer indication of the different scales of heat pump deployment alongside targets for other low carbon heating options across the various scenarios.

3. **Establish replacement rates –** if the heat pump deployment rate is to be sustainable, it would need to align with natural replacement cycles. Whilst it is recognised that accurately determining the replacement rate will only be possible once the market matures (since it partially depends on the number of installed heat pumps in a saturated market and the lifespan of the technology, both of which are undetermined) there is still value in linking estimated replacement rates to installation targets. Once these rates are established, deployment could be managed to avoid exceeding them, placing demands on supply chains that are unsustainable.

4. **Ensure that targets are achievable across sectors –** housing retrofit programmes and electricity network reinforcement will ultimately have to precede widespread heat pump adoption, the pace at which these occur will therefore partially dictate the rate of heat pump adoption. Aligning sector ambitions will be key to managing these dependencies.

5. **Alignment of local, national and UK-wide targets –** in future iterations, consideration could be given to demonstrating how LAEP heat pump deployment targets conform with national targets in Wales as well as UK-wide aspirations. Alignment along a common goal should help provide more market certainty, around which supply chains and the workforce can develop.

6. **Transparent modelling with well-referenced inputs –** the models used by the consultancies, to get the targets/projections, are opaque, inconsistent (between consultancies), and have poorly-referenced inputs. For projections to be considered more valid, these issues would need addressing so that stakeholders can start making informed decisions about what the projections mean to them.

7. **Inconsistency in modelling practices –** inconsistency between heat pump deployment trajectories across LAEPs, highlights the uncertainty surrounding how heat pump deployment is likely to progress. Given that labour forces and supply chains will develop across LA boundaries, it is counterintuitive to have neighbouring LAs following different roll-out curves. One potential solution to this issue would be for all LAEPs heat pump roll-out trajectories to follow the CCCs recognised 'S-curve' for low carbon technology deployment.

8. **GDNs need access to more granular heat pump installation data –** if GDNs had access to a more granular dataset which informed them of the type of central heating a heat pump was replacing, and the timing and location of occurrence, then they would have a better idea of the implications heat pump roll out will have on their network. Plan developers must be conscious of the fact that heat pump deployment is not necessarily evidence of gas boiler disconnections.

9. **Dynamic projections with trackable progress –** targets can quickly become unrealistic when an area has a couple of years of low heat pump deployment rates. At the moment, it is difficult to gauge how an area is performing against their targets because progress is not easily trackable. In most cases, LAs will have to wait until the next iteration of their LAEP to find out how heat pump deployment in the locality has progressed against key metrics. If heat pump deployment is progressing slower than expected, this not only pushes a potential response back five years but also makes LAEPs inherently reactive. It is therefore recommended that deployment targets are annualised and LAs provided with a way of tracking progress as it happens. This progress data could then be used to inform real-time decisions over which scenario is most appropriate to decarbonise the heating in a locality.

8.4.2 – Recommendations for more directive energy planning

If external energy plans are to become more directive, then they need to:

1. **Provide robust forecasts, instead of aspirational targets** – networks need to be provided with robust, transparent, data-driven, scenario-informed, and dynamic forecasts that replicate the granularity to which they produce their own forecasts. This would benefit from being done in conjunction with the networks.

2. **Have clear governance** – it must be clear to stakeholders whether the plans carry regulatory legitimacy and what governance authority those implementing them possess.

3. **Coordinate energy system transformation** – a clear, temporal, action plan would need to be developed that outlines expectations from different stakeholders, and the delivery of those actions needs to be driven and supported by those tasked with plan implementation.

4. **Push through changes to licence agreements** – currently, networks can only respond to energy plans as long as they are compliant with licence obligations. If energy plans are to become directive and enforce infrastructure transformation that are non-compliant with licence agreements, then networks' licence conditions will need to change.

5. **Be transparent with what is achievable** – the plans would need to clearly define achievable and sustainable technology adoption rates, based on credible skills and supply chain capacity targets. These rates could be treated as practical limits which, if exceeded, can be used to indicate whether alternative solutions need to be sought.

9 – Conclusion

This analysis has examined the implications of the heat pump deployment targets in LAEPs across Wales. It suggests that, across the majority of LAs, the achievement of the 2050 targets would necessitate rolling-out heat pumps faster than both the current gas boiler replacement rate and the heat pump deployment rates targeted by the CCC in the Seventh Carbon Budget. One possible reason for this disparity is that the heat pump deployment targets in the LAEPs are for widespread electrification scenarios, which likely overestimate the number of heat pumps that need to be deployed if heat network decarbonisation were to occur more holistically. This analysis demonstrated that without accelerating heat pump deployment immediately, and reaching maximum deployment rates as soon as possible, LAEP heat pump deployment targets will be very difficult to achieve.

Choosing heat pumps as the predominant technology to decarbonise the heat network, across most scenarios, in the majority of the LAEPs, seems inconsistent with the commitment of LAEPs to finding place-based solutions to locally specific issues. Since not all LAs have the resources or expertise to challenge the content of the LAEPs, using such a blanket approach risks stakeholders within localities targeting a false reality at the expense of working towards a more appropriate solution. As a minimum, it is suggested that LAEPs have at least one holistic scenario that presents an alternative route to heat network decarbonisation which is less reliant on heat pumps. In this way, if it becomes apparent that the widespread adoption of heat pumps is no longer achievable by 2050, then the holistic route can be adopted as an alternative that could still deliver on greenhouse gas emission reduction targets.

The report has also demonstrated that WWU's gas consumption forecast, for the next decade, is in line with the reduction in consumption that comes as a result of LAEP heat pump targets being realised. The analysis has also shown that the next price control period, 2031-2036, is when heat pump deployment could really start to impact GDNs, as heat pump deployment becomes more widespread. This could have a significant impact on the business models of GDNs and is likely to require regulatory changes that recognise this impact within the licence conditions that Ofgem places on them. Just as importantly, energy planning authorities need to recognise the constraints that Ofgem places on energy networks through licence conditions and price control frameworks and ensure that future energy system visions are achievable within these constraints, or, if not, that resource is allocated towards lobbying for modifications to these agreements/frameworks, to ensure that the changes can be delivered.

Even though this analysis suggests that there are ways in which LAEPs could be improved, their commissioning, by the Welsh Government, is undoubtedly a step in the right direction for the realisation of local decarbonisation goals. While the plans clearly have merit, this analysis suggests they will require refinement if they are to guide local decarbonisation efforts. This report has attempted to outline how the plans could be improved so that later iterations are more effective in driving through the changes needed to deliver decarbonisation at a local level.

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Appendix A: Gas boiler replacement rate/ 'Match Gas' maximum deployment rate calculation

The LA apportioned national gas boiler replacement rate was calculated as follows:

Data for central heating type was taken from 2021 census data, found at Office of National Statistics central heating (ONS, 2021).

For each LA, the data is broken down into 13 heating technology types. Three of these, Mains Gas, Two Types of Central Heating, Two or More Types of Central Heating (including renewable energy), include gas boilers. Since the two 'Two or More Types of Central Heating' categories don't specify the types of technology used, assumptions had to be made to get a figure for the number of gas boilers in each:

- **Two or more types of central heating –** where a property was recorded as having 'two or more types of central heating', it was assumed that the presence of a gas boiler followed the same proportion as among households with single type of heating for each LA.
- **Two or more types of central heating (including renewable energy) –** it was assumed that 33% retained a gas boiler. This reflects a cautious estimate of hybrid system adoption, where renewable technologies are increasingly present but often supported by conventional systems during early roll-out phases.

Adding these two estimates to the number recorded in 'Mains Gas' gave an approximation for the total number of gas boilers in an area.

For each LA, the ratio of this number to the number of total gas boilers in the UK was multiplied by the national gas boiler replacement rate.

Cumulating this maximum heat pump deployment rate, for all LAs across Wales, gave a national deployment rate of 83,000. Cross-checking this against the annual gas boiler installation rate, estimated by Welsh Government in the Heat Strategy for Wales, of 80,000, shows that the calculation is within the tolerated accuracy for this analysis (Welsh Government, 2024).

Appendix B: Arup rate of change graph

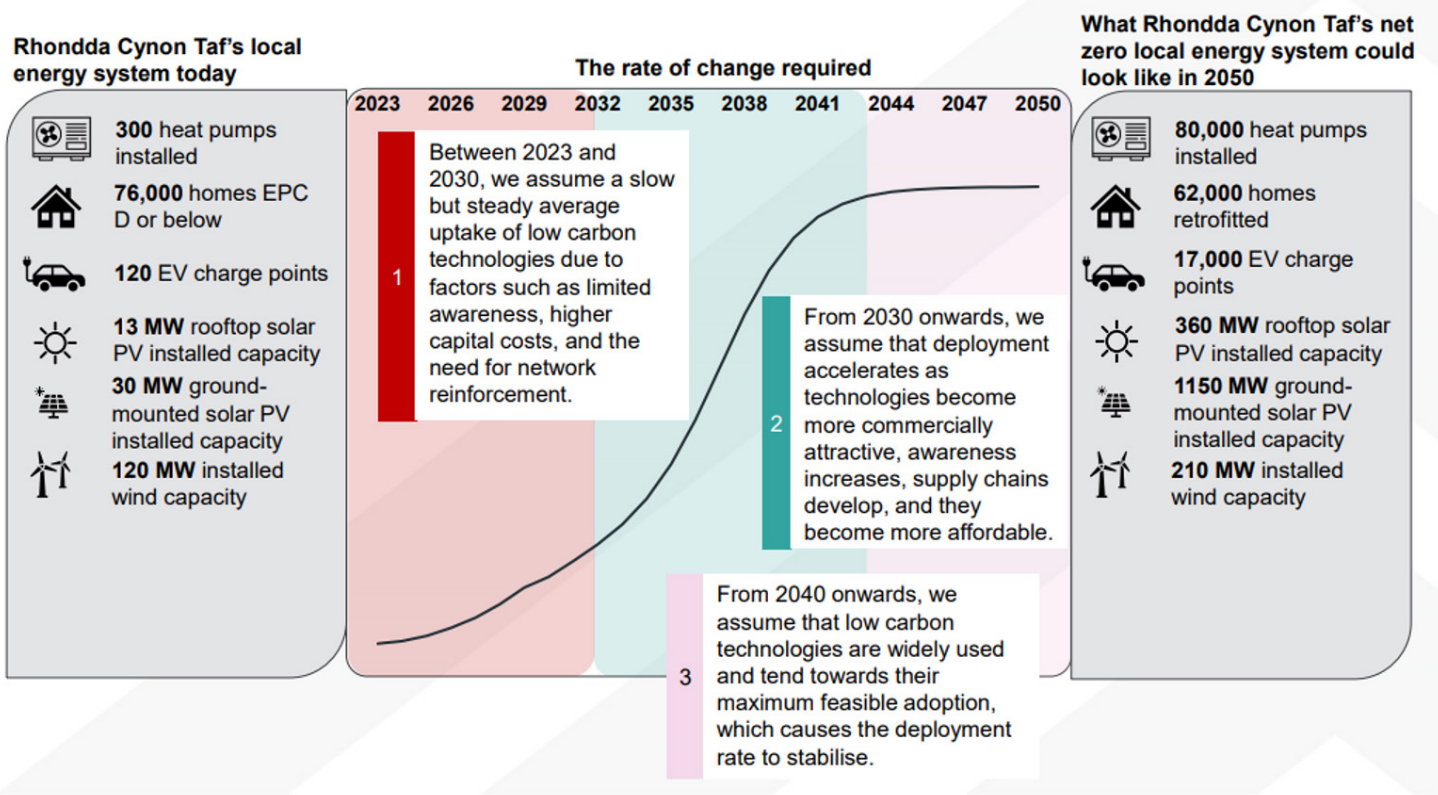

Figure 18 - Rate of Change Graph displayed on Arup LAEPs (Rhondda Cynon Taf LAEP, 2024)