

Winchester LAEP



Scottish & Southern
Electricity Networks



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1 Executive Summary

1.1 Overview

The Winchester Local Area Energy Plan (LAEP) presents plausible routes to transition the district to a net-zero energy system. It considers multiple pathways, including electricity, heat, transport, and the built environment, to achieve a sustainable, low-carbon future. Winchester City Council are working in partnership with Advanced Infrastructure Technology Limited (AITL) and Scottish and Southern Electricity Networks (SSEN) to develop a LAEP for the Winchester district.

Collaboration among stakeholders on this Local Area Energy Plan produced four key artefacts:

1. **Winchester Local Area Energy Plan** (this document): An overview of potential scenarios for Winchester, concluding with the preferred route forwards and key action areas.
2. **Assumptions and Methodology Report**: An accompanying technical report which provides further detail on the inputs, assumptions and methodologies used to produce the Local Area Energy Plan. This can be found in the appendix of this report.
3. **Baseline Report**: A dedicated report summarising the baseline, i.e. the current state of the system, used to underpin the overall Winchester Local Area Energy Plan.
4. **LAEP+ Masterplan**: a live digital planning interface on the LAEP+ Platform which brings together approved projects and scenarios, providing stakeholders with an up-to-date view of likely developments.

What is a Local Area Energy Plan (LAEP)?

A LAEP is a whole-systems plan to transition a local area's energy system to net zero. The outputs are a costed, spatial plan that identifies the changes needed to the local energy system and built environment to achieve a carbon neutral target.

"The LAEP scope addresses electricity, heat, and gas networks, future potential for hydrogen, the built environment (industrial, domestic and commercial) its fabric and systems, flexibility, energy generation and storage, and providing energy to decarbonised transport e.g. electricity to electric vehicles and charging infrastructure."

Energy Systems Catapult, 2025



1.2 Emissions and Targets

1.2.1 Winchester's Goals & Policies on Net-Zero

Winchester City Council declared a climate emergency in 2019 and set an ambitious target for the district to be carbon neutral by 2030. Tackling the climate emergency and becoming greener faster is the overarching priority of the council, as set out within the Council Plan 2025-2030.

The council's Carbon Neutrality Action Plan 2023-2030 (CNAP) outlines how the council will work with partners to achieve its carbon neutrality target. The council recognises the contribution that decarbonising the local energy system will play in achieving this target, and has identified key pathways and actions to enable the transition of the energy system to carbon neutral including:

- Reducing energy consumption by promoting energy efficiency in buildings and low-carbon heat.
- Reducing transport emissions by encouraging the creation of active travel infrastructure and supporting the installation of public electric vehicle charging points.
- Increasing renewable energy generation and purchase within the Winchester District through installing solar panels on council owned buildings when viable and supporting commercial building owners to also look at installing solar.

Winchester City Council has already taken significant steps to reduce council emissions, as evidenced by their 2024/25 carbon footprint which shows that direct council emissions have reduced by 96% since the baseline year of 2017/18. This was due to a number of factors including switching council sites to a 100% green electricity and green gas tariff and replacing the council housing fleet with fully electric vehicles.

Indirect emissions have also reduced by 41% compared to the 2023/24 baseline year, which has been achieved in large part by switching the fleet of waste vehicles and Park and Ride buses to low carbon (Hydrotreated Vegetable Oil (HVO)) fuel and purchasing 100% green electricity for both Meadowside Leisure Centre and Winchester Sport and Leisure Park.

1.2.2 Current Emissions

Winchester's district emissions are calculated annually, using data from the Government's Department for Energy Security and Net Zero (DESNZ). The most recent government data shows that the annual greenhouse gas emissions for Winchester district is 768.6ktCO₂e. These emissions stem from a range of sectors, with transport being the largest contributor, accounting for almost half of all district-wide emissions. Across all scenarios considered in the LAEP, this number is reduced substantially through changes to building stock, energy generation and transport. Changes to agriculture and public transport services like trains are not considered in the scope of this LAEP, meaning approximately 517.9ktCO₂e out of 768.6ktCO₂e are addressed by changes discussed in this report.

Emissions from transport are distributed between road transport on motorways (38%), minor roads (32%), and A roads (28%), highlighting the potential for expanding vehicle electrification across the district. Domestic buildings are responsible for ~20% of overall district-wide greenhouse gas emissions; of those residential emissions, 58% come from domestic gas use and 25% from electricity use. This is largely due to the district's reliance on natural gas for heating purposes, with a majority of Winchester's residential areas located within on-gas postcodes. The prevalence of gas-heated homes emphasises the need to transition heating systems in domestic buildings to electrified and low carbon heating sources. Lastly, the agriculture sector accounts for 14.5% of greenhouse gas emissions, primarily driven by livestock and soil management practices.

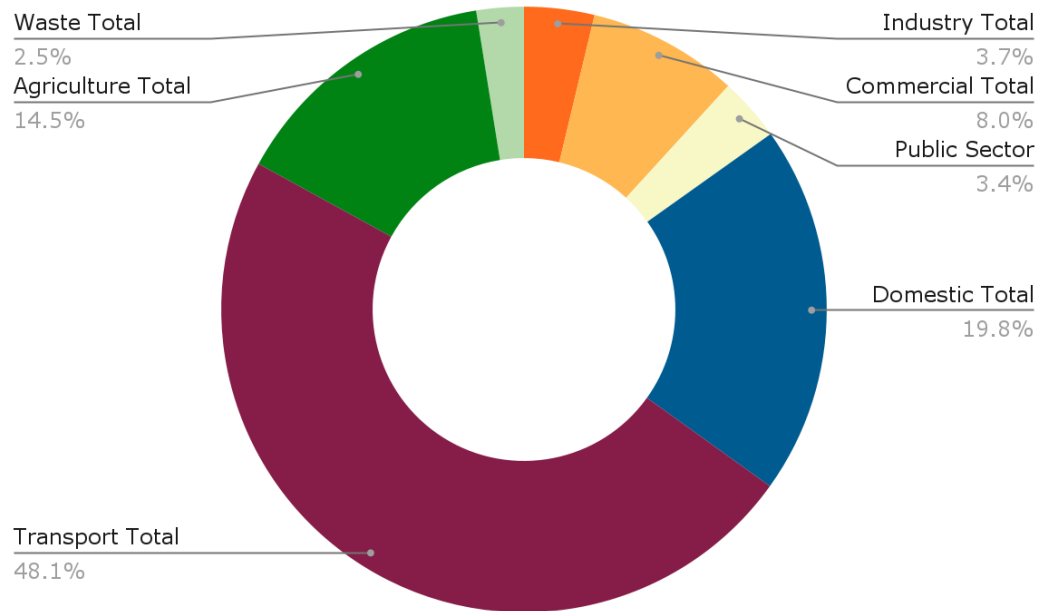


Figure 1: Total greenhouse gas emissions by sector.

1.3 Stakeholder Engagement

Stakeholder engagement is a key element of developing a Local Area Energy Plan, the Winchester District Local Area Energy Plan has followed the engagement guidance set out in the Energy Systems Catapult guide.

At the start of the project a stakeholder mapping exercise was conducted to identify the primary and secondary stakeholders for this project. The primary stakeholders are Winchester City Council, Advanced Infrastructure Technology Limited and Scottish and Southern Electricity Network. The secondary stakeholders consist of a range of organisations including neighbouring local authorities, Winchester Action on the Climate Crisis and CPRE.

The first secondary stakeholder session consisted of an online workshop to introduce local area energy planning and the scope of this project. Some findings from the baseline were shared and attendees were able to ask questions to the project team.

Additional stakeholder engagement took place at a meeting with the Greener Futures Partnership in June 2025. This partnership is a collective of local organisations and businesses who are interested in the climate and nature emergencies and/or green economic development. The LAEP project was presented by representatives from WCC, AITL and SSEN. The presentation included a demonstration of the Local Net Zero Accelerator Tool (LENZA) and an overview of the findings from the energy baseline assessment. Participants were also asked a range of questions, such as how likely they would be to install these renewable technologies at home, to help us to inform the LAEP.

In September 2025 WCC were invited to run a LAEP focused session for the Winchester Climate Action Network. This network is made up of climate resident groups from across the district. WCC also

presented at the Leading Climate Action conference which is organised by Winchester Action on the Climate Crisis for parish, city and county councillors.

The Sustainability Team also identified organisations within the district who were likely to be large energy users. This included:

- NHS
- University of Winchester
- IBM
- Arqiva
- Sparsholt College
- Winchester Cathedral
- Acorn Bioenergy

Throughout 2025 and early 2026 discussions were held with representatives from these organisations to ascertain how they currently manage their energy needs, if they have any future energy projects planned and what their main energy challenges are – especially in relation to transitioning to net zero energy. These conversations, as well as engagement with secondary stakeholders have been hugely beneficial in understanding the barriers to a net zero energy system and what support Winchester City Council could offer to businesses and residents.

Stakeholder engagement will continue to be an important aspect following the delivery of the Local Area Energy Plan as the transition to a net zero energy system in the Winchester District will require input from a range of actors.

1.4 The Scenarios Explored

The five primary scenarios presented in this report explore cost, carbon impact and feasibility across three different net zero end dates and various assumptions. The recommended pathway for Winchester is the **Medium Ambition** pathway - spanning years 2025 to 2040, delivering substantial emissions cuts at an ambitious but realistic pace.

High Ambition (2025-2030)

This scenario models the maximum carbon reduction that can realistically be achieved by 2030. This scenario does not reach all targets but demonstrates what can be achieved with accelerated efforts to decarbonise.

Medium Ambition (2025-2040)

This more gradual pathway aims to achieve net zero by 2040. This scenario achieves substantial emissions reductions through electrification, local generation, storage, and transport shifts.

Low Ambition (2025-2050)

A slower approach which aligns with the Hampshire County Council and the national 2050 target. Electrification, especially heat pumps, drives reductions alongside local generation, storage and transport shifts.

High Hydrogen (2025-2050)

The only scenario which assumes hydrogen becomes a widely available fuel source from the late 2030s across both domestic and non-domestic spheres. The most uncertain scenario, it is ultimately subject to national policy decisions.

Business as Usual (2025-2050)

This scenario reflects only decarbonisation activities between now and 2050 that are committed to happen (e.g. the Future Homes Standard after 2027). Intended for comparison only and does not meet net zero targets.

In the **Medium Ambition** scenario, net zero is plausible if measures such as decarbonising domestic heating and an accelerated shift to electrified transport take place. However, depending on the decarbonisation of the national grid and implementation of other activities to reduce carbon, net zero may only be possible if offsets are used. If offsets are ruled out, some further action post-2040 would be needed to reach net zero.

The **Low Ambition** scenario reaches net zero by 2050, in line with the national net zero target. **High Hydrogen** is policy-dependent and the potential emission factor of hydrogen may mean this scenario cannot reach net zero. **High Ambition**, while demonstrating potential acceleration rates, does not achieve net zero by 2030. **Business as Usual** evidences the gap if very limited action is taken.

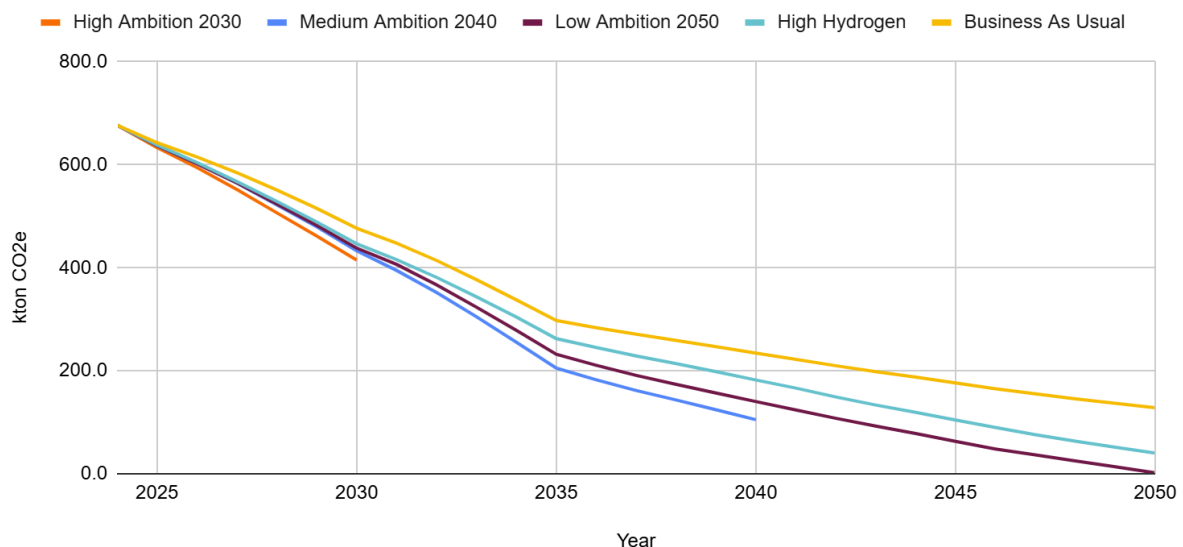


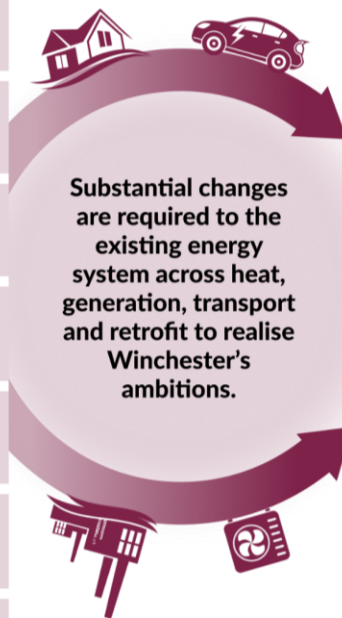
Figure 2: Carbon emission reductions compared across each scenario pathway.

1.5 Scale of Change Required

Winchester's energy system will need to change significantly to achieve its net zero targets. Significant changes are required to realise substantial impact, with meaningful system-wide transformation emerging between 2040 and 2050.

Winchester Today (2025)

	Heat pumps installations 1,102
	District heat connections 0
	Alternative electric heating installations Limited
	Rooftop PV (sometimes with storage) ~35 MW
	Large scale generation 93 MW
	Private EV chargepoints 4344 est.
	Public EV chargepoints 219
	Average EPC D



A Possible System (2040-50)

	Heat pumps installations 34,978-48,567
	District heat connections 6,852
	Alternative electric heating installations 8,285-19,543
	Rooftop PV (often with storage) 269-352 MW
	Large scale generation 292 MW
	Private EV chargepoints 30,116
	Public EV chargepoints 2,200
	Properties with insulation installs 40,000+

Figure 3: An overview of the scale of transformation possible across Winchester's energy system.

1.6 Priority Actions

Priority intervention themes represent the core areas of action required to deliver a resilient, low-carbon energy system. Specific low regrets opportunities are discussed further in Section 5 - Implementation.

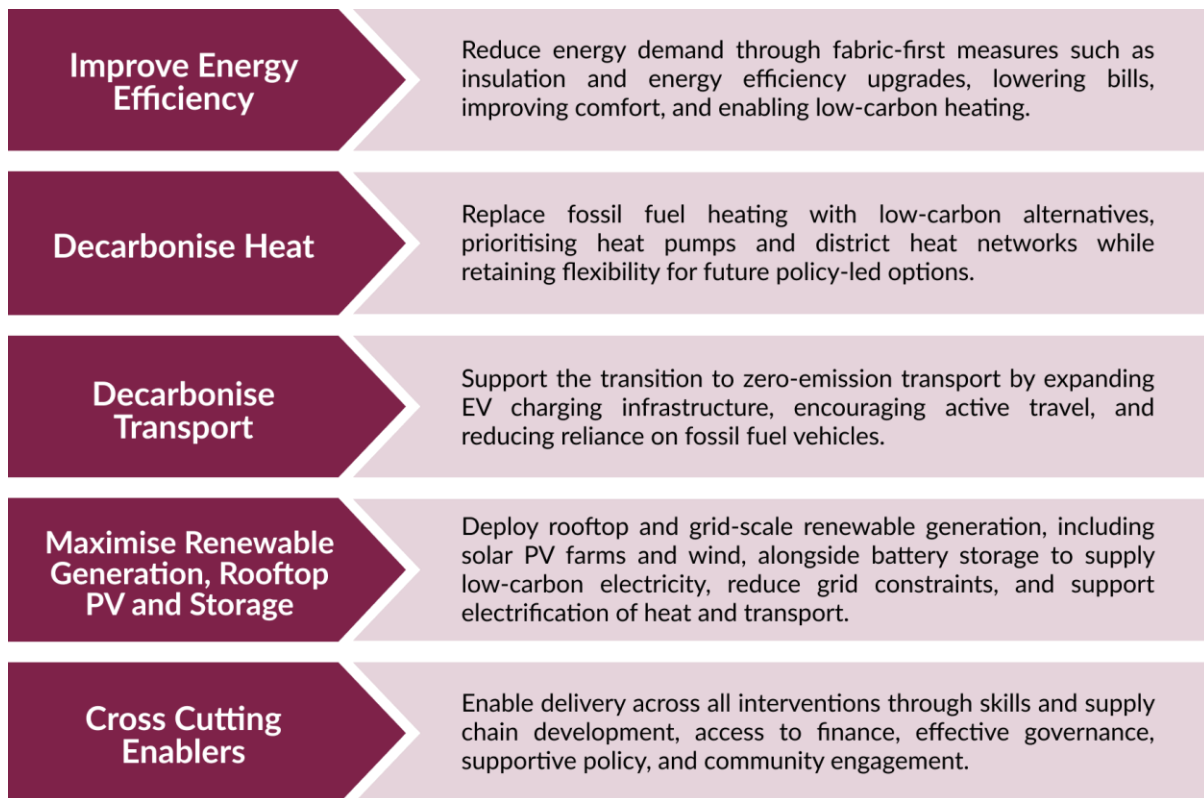


Figure 4: Priority interventions themes for Winchester.

1.7 Benefits of Renewable Technology

Renewable and low-carbon technologies reduce emissions by displacing fossil fuel use, improving efficiency, and electrifying demand. In Winchester, the high suitability of buildings for air source heat pumps (ASHP), rooftop PV, and hydrogen boilers demonstrates strong potential to cut heating and electricity-related emissions. Ground-mounted solar PV and large-scale wind could deliver a considerable supply of renewable electricity helping to decarbonise local electricity supply. Meanwhile, the transition to electric vehicles will eliminate tailpipe emissions and reduce transport-related carbon emissions. Together, these technologies form the backbone of Winchester's pathway to net zero, delivering significant reductions in carbon emissions while improving energy resilience.

Assessing renewable potential of these technologies enables energy planners to quantify the scale of feasible deployment across technologies, identify where opportunities are greatest, and highlight constraints that may limit uptake. The table below shows building-level suitability for low-carbon technologies.

Table 1: Current building-level suitability for Low Carbon Technologies.

Technology	Domestic (%)	Non-Domestic (%)
Rooftop PV	76	74
Air Source Heat Pump	90	53
Ground Source Heat Pump	35	33
Hydrogen Boiler	82	66
Insulation Cavity Wall	16	N/A
Insulation External Wall	15	N/A
Insulation Loft	5	N/A
Insulation Underfloor	67	N/A

* Hydrogen based heating is not yet readily available. Such installs are only considered in the High Hydrogen scenario where it is assumed properties currently connected to the gas network could theoretically transition to hydrogen. Non-domestic insulation data is very limited and falls outside the scope of this LAEP's modelling. Domestic insulation suitability is assessed by identifying properties that do not yet have insulation installed. In areas where suitability appears low, this is often because a large proportion of homes already have insulation in place.

The suitability of land parcels for ground-mount PV can be assessed by evaluating constraints such as land availability, risks, and planning restrictions. Across the Winchester District, approximately 56 km² of land meets these suitability criteria. Of the 4,956 land parcels considered for ground-mount PV deployment, 24% are fully suitable, while 7% may be suitable. The combined generation potential of the fully suitable parcels is 470 GWh, highlighting significant potential, should Winchester pursue large-scale deployment of ground-mount solar PV.

Winchester's pathway to net zero will require coordinated, and rapid district-wide action over the coming years, with early progress laying the foundations for the deeper system changes expected from 2040 onwards. The scenarios explored in this LAEP demonstrate that while technologies and behaviours can begin shifting now, the most substantial transformation of the energy system will emerge later as infrastructure, supply chains and consumer adoption mature. By acting decisively today - across buildings, transport, renewable generation and local partnerships - Winchester can position itself to capture the full benefits of this transition and ensure that the district is prepared for the scale of change required to meet its long-term climate ambitions.

2 The Current Energy System

A clear understanding of Winchester District's existing energy system is essential to shaping the Local Area Energy Plan. A supporting Baseline Report provides a more detailed assessment of current conditions, while this following summary highlights the elements most relevant to the district's future transition. This includes an overview of building stock characteristics, patterns of energy consumption, across sectors, alongside an assessment of renewable energy potential. Establishing this baseline ensures that the scenarios and interventions explored in the LAEP are grounded in an accurate representation

of Winchester's starting position and the opportunities and constraints that will influence the district's pathway to net zero.

2.1 Buildings

2.1.1 Existing Domestic Buildings

The Winchester region is predominantly made up of domestic properties, accounting for 86% (62,058) of all documented buildings by Unique Property Reference Number (UPRN). Among these, 58,921 are classified as dwellings, with each dwelling covering an average area of 130.5m². Examining the distribution of different housing archetypes reveals that 33.5% are detached properties, 24.6% are semi-detached, and 21.7% are terraced homes. Categorising buildings into archetypes is useful, as each building type has distinct energy consumption patterns, retrofit requirements, and carbon reduction potential, all of which will be explored in the following sections.

Winchester has 40,813 EPCs recorded in the EPC Register, and an inference process has been applied to estimate ratings for properties without an official EPC. The results show that the most common EPC rating is D (36%), followed closely by C (around 35%). This distribution indicates that significant improvements are still needed across the district's housing stock, particularly through measures such as enhanced insulation and the adoption of low-carbon heating systems.

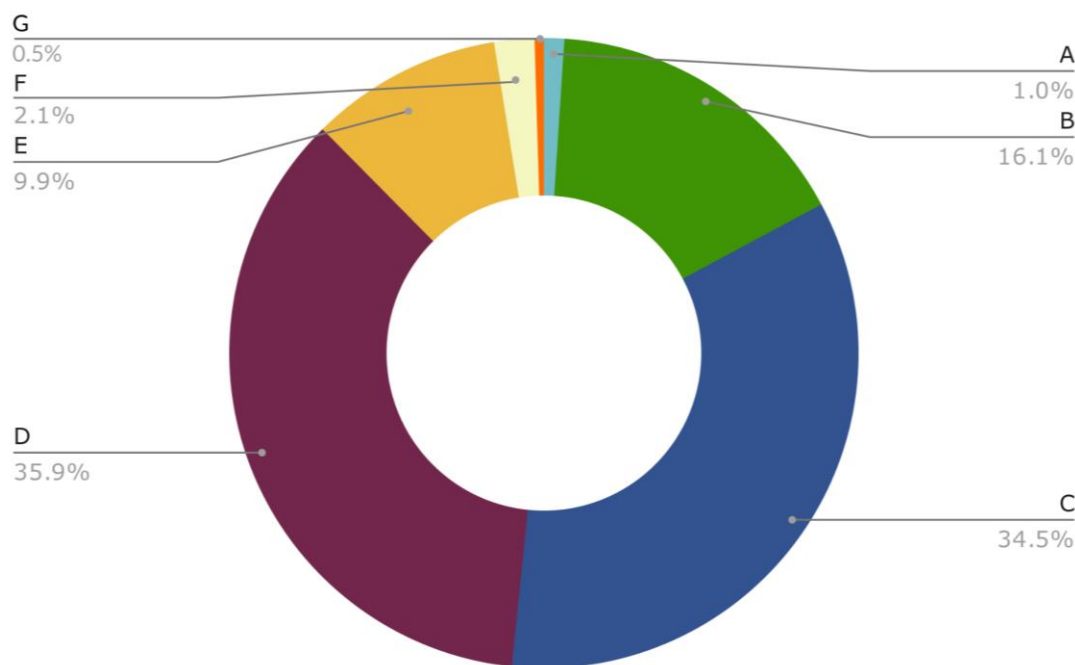


Figure 5: Distribution of domestic EPC ratings.

Beyond EPC ratings, it is important to understand the primary fuel types used in domestic properties. 78% of homes currently rely on gas as their main fuel source, followed by electricity and oil. Establishing a baseline for fuel types is essential for scenario modelling, as it provides a clear reference point to assess shifts in energy use across the district's domestic buildings over time.

2.1.2 Existing Non-Domestic Buildings

There are 7946 commercial buildings across the Winchester district, with the most common commercial uses including offices, retail spaces, and industrial buildings, each contributing significantly to local

energy demand and economic activity. The most common EPC rating among non-domestic buildings in the Winchester district is C, representing 33% of properties. Notably, 45% of all non-domestic buildings in the EPC register have a rating lower than C, highlighting a significant opportunity for energy efficiency improvements and decarbonisation strategies within Winchester's non-domestic building stock. In addition, 54% of non-domestic buildings in Winchester rely on grid-supplied electricity as their primary fuel source, while 38% depend on natural gas.

2.2 Current Energy Demand and Consumption

Fuel demand in Winchester is predominantly driven by domestic consumption, with gas and electricity forming the core of the district's energy profile. Baseline gas demand totals 724 GWh, comprising 533 GWh from households and 190 GWh from non-domestic buildings. This reflects the district's largely residential character, where domestic properties significantly outnumber commercial and industrial sites. Electricity consumption stands at 556 GWh, split between 223 GWh domestic and 332 GWh non-domestic use. The higher non-domestic share indicates the presence of energy-intensive commercial and institutional loads across the district.

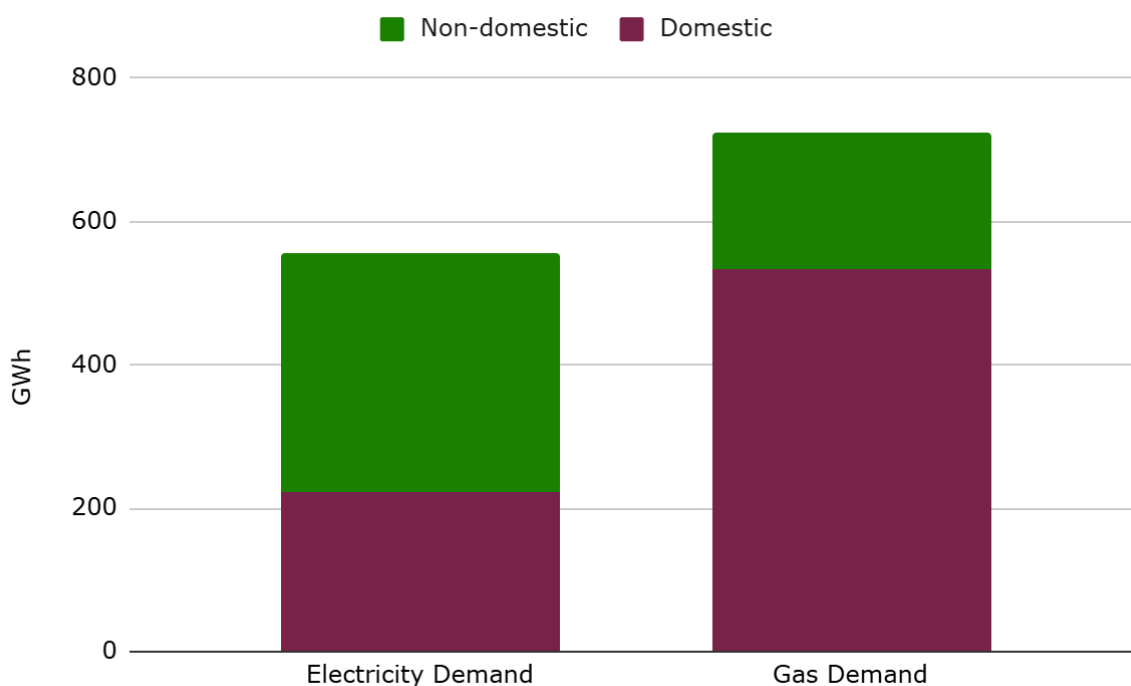


Figure 6: Distribution of energy demand by domestic and non-domestic Sector.

2.3 Existing Energy Infrastructure

2.3.1 Existing Low Carbon Technologies

The Microgeneration Certification Scheme (MCS) provides local records of existing renewable energy installations. Rooftop solar PV is currently the most widely adopted technology in Winchester, followed by air source heat pumps. Additional assets include 68 biomass systems, three wind turbines, one micro-CHP unit, and 185 battery storage systems - though some capacity data on these remains unreported. In terms of grid scale generation, there is approximately 93MW of large scale generation - predominantly from solar farms.

Winchester also hosts 219 public EV charging stations, equating to approximately 166 per 100,000 residents - well above the UK average of 113 - reflecting the district's expanding transport infrastructure. The table below presents baseline figures for existing renewable technologies, which form the foundation for later scenario modelling. Please note that insulation figures have been inferred from the domestic EPC register and do not directly reflect the raw source data, due to gaps and missing values.

Table 2: Number and percentages of buildings with existing assets in Winchester.

Technology	Domestic (No.)	Domestic (%)	Non-Domestic (No.)	Non-Domestic (%)
Rooftop PV	3571	6.1	2092	31.5
Air Source Heat Pump	1020	1.7	27	0.4
Ground Source Heat Pump	47	0.1	8	0.01
Insulation Cavity Wall*	35592	60.4	N/A	N/A
Insulation External Wall*	1850	3.1	N/A	N/A
Insulation Loft*	45077	76.6	N/A	N/A
Insulation Under Floor*	9719	16.5	N/A	N/A

**Data on existing insulation for non-domestic insulation is very limited and falls outside the scope of this LAEP's modelling. Domestic insulation suitability is assessed by identifying properties that do not yet have insulation installed. In areas where suitability appears low, this is often because a large proportion of homes already have insulation in place*

2.3.2 Existing Energy Networks

The Winchester district consists of 3,857 postcodes, of which 2,786 (72.2%) are currently connected to the gas network. Within these areas, 45,019 domestic properties rely on gas as their primary fuel source. The remaining 27.8% of postcodes are classified as off-gas, primarily situated in Winchester's rural regions, comprising ancient woodlands and conservation areas, where residential and non-domestic buildings are sparse. Gas-supplied postcodes are supported by a mix of pipeline materials, including polyethylene, cast iron, ductile iron, spun iron, and steel. Under the Iron Mains Replacement Programme, all metal mains will transition to hydrogen- or biomethane-ready polyethylene pipes by 2032. Currently, 84% of Winchester's gas mains have already been transitioned to polyethylene which the gas networks consider to be "hydrogen-ready".

The existing electricity network in Winchester is laid out in more detail in section 6.4 Electricity Grid Readiness which reviews existing assets and constraints.

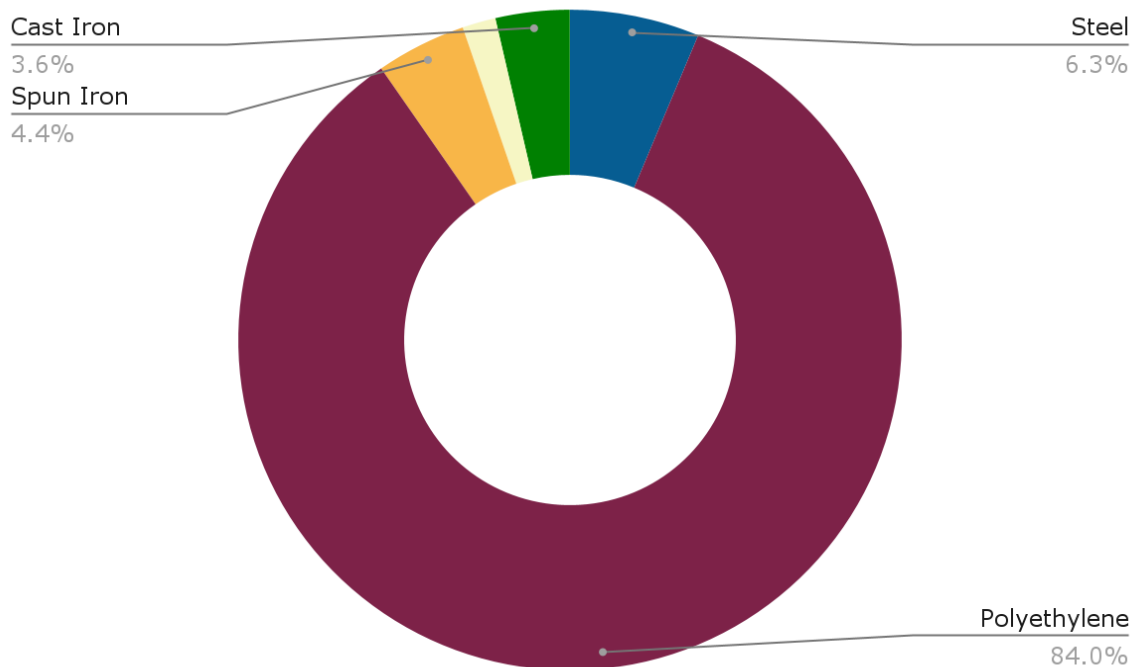


Figure 7: Distribution of pipe materials in Winchester's gas network.

3 Options for Future: Scenarios

3.1 Scenarios

The five scenarios in this LAEP reflect different pathways towards net zero across three possible end dates: 2030, 2040 and 2050. Each scenario explores how different targets, technology priorities, and timelines, affect outcomes enabling Winchester to select the pathway that best aligns with local conditions and ambition. Each scenario models domestic and non-domestic building stock separately to take account of distinct energy use patterns, function and opportunities.

"Business as Usual" Scenario - 2050

This scenario reflects only decarbonisation activities between now and 2050 that are committed to happen (e.g., the ban on new petrol and diesel cars after 2030 and Future Homes Standard after 2027). It does not reflect undecided policy areas. This scenario generally does not show a pathway to decarbonise and is intended to be used as a baseline against which other scenarios can be compared. In our analysis, this scenario assumes the current rates of technology installation remain constant and do not accelerate significantly. As the baseline case required within Local Area Energy Planning, it provides the essential and mandatory reference point against which the impact of all other scenarios can be assessed.

"High Ambition" Scenario - 2030

This scenario models the maximum carbon reduction that can realistically be achieved by 2030. It represents the most ambitious pathway under consideration and reflects the council's target for Winchester District to reach carbon neutrality by 2030. This scenario assumes significant efforts are put in place to accelerate uptake of low carbon technologies, whilst being realistic about what changes can

be achieved in the time remaining.

“Medium Ambition” Scenario - 2040

This scenario sets 2040 as the net zero target year, positioning it as a balanced pathway between Winchester’s 2030 ambition and the national 2050 target. The 2040 timeline also reflects a pragmatic midpoint that supports long-term planning across the region. Significant acceleration in low carbon technology uptake and deployment is required to meet this outcome.

“Low Ambition” Scenario - 2050

This scenario aligns with the UK Government’s statutory 2050 net zero target, often referred to as the national net zero pathway. Like other scenarios, it models low-carbon heating, rooftop PV, electric vehicles and large-scale renewable generation. The 2050 trajectory is also consistent with the Hampshire County Council’s net zero commitments. As the nationally defined reference pathway, its inclusion provides the required benchmark against which locally accelerated scenarios can be assessed.

“High Hydrogen” Scenario - 2050

This scenario assumes hydrogen becomes a major zero-carbon fuel from the late 2030s for both domestic and non-domestic consumers. Hydrogen is introduced primarily for heating and industry, with limited hydrogen-based transport considered in the Winchester area. This scenario allows Winchester to understand the implications of a hydrogen-led heating transition compared to electrification-dominant pathways. This scenario mostly closely aligns with the 'Hydrogen Evolution' scenario within the national Future Energy Scenarios (FES). The high uptake of hydrogen assumed within this scenario will depend on the outcome of the government's forthcoming policies on hydrogen.*

	🎯 AMBITION	📋 POLICY CONTEXT	⚡ TECHNOLOGY FOCUS
2050 BUSINESS AS USUAL	No decarbonisation target.	Considers only confirmed policy actions that are known to be going ahead.	Slow uptake of rooftop PV, low-carbon heating technologies and insulation.
2030 HIGH AMBITION	Achieve net zero by 2030.	Reflects the Winchester district carbon neutrality target.	Rapid rollout of rooftop PV, low-carbon heating technologies and insulation.
2040 MEDIUM AMBITION	Achieve net zero by 2040.	Positioned between regional and national goals.	Moderate deployment across rooftop PV, low-carbon heating technologies insulation and significant progress in large-scale renewable generation.
2050 LOW AMBITION	Achieve net zero by 2050 in line with the UK Government target.	Aligns with national legislation and transition planning.	Decarbonising transport and deployment of rooftop PV, low-carbon heating technologies, insulation and large-scale renewable generation.
2050 HIGH HYDROGEN	Achieve net zero by 2050 using hydrogen as a key fuel.	Builds on UK Hydrogen Strategy and CCC hydrogen pathways.	Hydrogen boilers, hydrogen ready areas, low-carbon heating technologies, rooftop PV, and reduced reliance on full electrification.

Figure 8: The five scenario pathways in this Local Area Energy Plan.

* The UK government is set to make a strategic decision in 2026 regarding the role of hydrogen in domestic heating, following a comprehensive review of safety, feasibility, and cost evidence

3.2 Scenario Targets

This section assesses each scenario against defined targets set by Winchester council, expressed as percentages of the domestic and non-domestic building stock in Winchester. It combines current installations with projected uptake to show the cumulative share of buildings adopting each technology by the scenario end date.

Performance against targets varies significantly across technologies and scenarios, revealing both areas of strong progress and persistent deployment challenges. The targets set by Winchester City Council are detailed in the Assumptions and Methodology report. Where a target has been met or exceeded, it is shown in green in Figure 9. Not meeting a specific technology target in the table below does not necessarily mean the pathway fails to achieve net zero overall. A scenario may still deliver sufficient emissions reduction through other measures, including the deployment of technologies such as alternative heating systems.

	2050	2030	2040	2050	2050
	DO NOTHING	HIGH AMBITON	MEDIUM AMBITON	LOW AMBITON	HIGH HYDROGEN
DOMESTIC					
Cavity Wall Insulation	67%	69%	76%	77%	76%
Loft Insulation	82%	82%	82%	82%	82%
Under Floor Insulation	18%	19%	23%	26%	28%
External Wall Insulation	3.5%	3.6%	4.3%	5%	5.2%
ASHP	9%	16%	55%	55%	17%
GSHP	0.26%	0.62%	2.47%	3.42%	0.64%
Heat Network	—	6.7%	6.7%	6.7%	6.7%
Hydrogen Boiler	—	—	—	—	78%
Rooftop PV	32%	22%	42%	48%	59%
NON-DOMESTIC					
ASHP	2.1%	3.9%	13%	13%	18%
GSHP	0.1%	1%	3.8%	3%	3.4%
Heat Network	—	45%	45%	45%	45%
Hydrogen Boiler	—	—	—	—	62%
Rooftop PV	80%	81%	80%	81%	80%
NET-ZERO OUTCOME	×	×	✓	✓	✓

Figure 9: Final deployment percentages of each LCT, including existing installations. Note: Hydrogen boilers and Heat Networks start from zero in Winchester, so percentages shown represent entirely new deployment.

The **High Ambition 2030** scenario faces a significant challenge: to accelerate uptake and deployment rates significantly above the current baseline. For established technologies like rooftop PV this is less challenging as uptake rates are already strong. However, energy efficiency and heating upgrades do pose a significant challenge to achieving Winchester's 2030 ambitions. Later scenario end dates benefit greatly from upcoming policy changes, market trends, technology development and additional time to boost uptake. This is true for both domestic and non-domestic building stock, though the effect is more marked in non-domestic buildings due to their greater complexity to decarbonise fully.

3.3 Hydrogen for Local Energy Planning

Hydrogen has been modelled as a distinct scenario (High Hydrogen pathway) to reflect the current uncertainty surrounding its future role in domestic heating and wider energy systems. The UK Government has not yet taken a final decision on whether hydrogen will be used in homes, and several national trials and policy reviews are still underway. Given the potential implications of these decisions for local infrastructure, network planning and long-term investment, it is important to understand how Winchester's energy system might evolve under a hydrogen-enabled pathway. Modelling this scenario provides insight into the scale of hydrogen demand that could arise, the associated requirements for distribution networks, and the extent to which hydrogen could act as an alternative to widespread electrification and air-source heat pumps. Including this pathway enables comparison with other scenarios and supports a more resilient planning approach by considering a range of plausible national policy outcomes.

4 The Future Energy System

4.1 Buildings

4.1.1 A Note on Interpreting Deployment Charts

This section outlines how different low-carbon technologies are deployed across each pathway. When interpreting the results, it is important to note that, unless stated otherwise in the figure title, the values shown represent total installations, meaning the existing baseline plus new installations added through the pathway. The 2025 starting point therefore reflects the baseline position combined with installations occurring in the first modelling year. Percentages on the charts represent the proportion of domestic or non-domestic buildings that have the technology installed. Annual deployments from the baseline year are based on building level suitability and Winchester's targets and assumptions about realistic uptake rates. Realistic uptake rates are based on historic installation trends for Winchester as well as each scenario's level of ambition. These assumptions are detailed in the Assumptions and Methodology report section 2.3.

4.1.2 Insulation

Improving insulation and other energy efficiency measures is a priority across all scenarios because it reduces energy bills, boosts energy efficiency, and helps technologies like heat pumps perform better by minimising heat loss. In Winchester the most common EPC ratings are D (36%) and C (35 %). Of the properties with an EPC record, a large proportion already have loft insulation (53.25% of homes with an EPC) and cavity wall insulation (47.77% of homes with an EPC), but far fewer have floor insulation (6.53% of homes with an EPC) or external wall insulation (4.21% of homes with an EPC). The baseline analysis for this LAEP inferred a similar proportion for homes without EPC records. This reflects the historical pattern of retrofit activity: loft and cavity wall insulation have long been the most accessible, and widely promoted measures, whereas floor and external wall insulation typically require more substantial works and have therefore seen slower uptake to date.

Across cavity wall, underfloor and external wall insulation, the High Ambition scenarios show the lowest installation rates in the near term, assuming current uptake trends cannot be significantly altered within the next five years. Loft insulation, however, follows a different pattern: the remaining suitable uninsulated homes are taken up rapidly by 2030, highlighting strong potential. For the other insulation measures, progress becomes more visible as the pathways extend beyond 2030. In the Medium Ambition pathway, most remaining uninsulated cavity wall properties are addressed by 2040.

By 2050, in the Low Ambition and High Hydrogen pathways, we also see steady growth in underfloor and external wall insulation as these technologies begin to mature and become more routinely delivered. Final installation numbers by 2050 for underfloor and external insulation remain lower because these measures apply to a more limited proportion of the housing stock and begin from a comparatively small existing baseline. As a result, the scenarios project a more incremental growth profile for these insulation types than for more established interventions such as loft or cavity wall insulation.

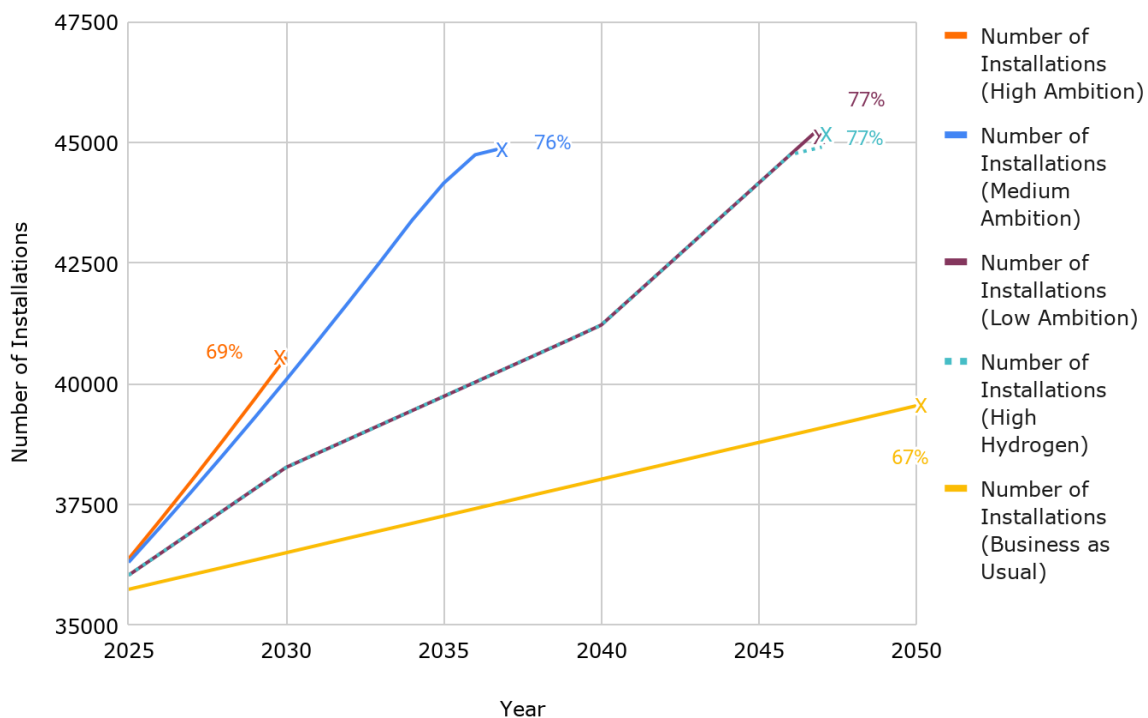


Figure 10: Deployment rates of cavity wall insulation across scenario pathways.

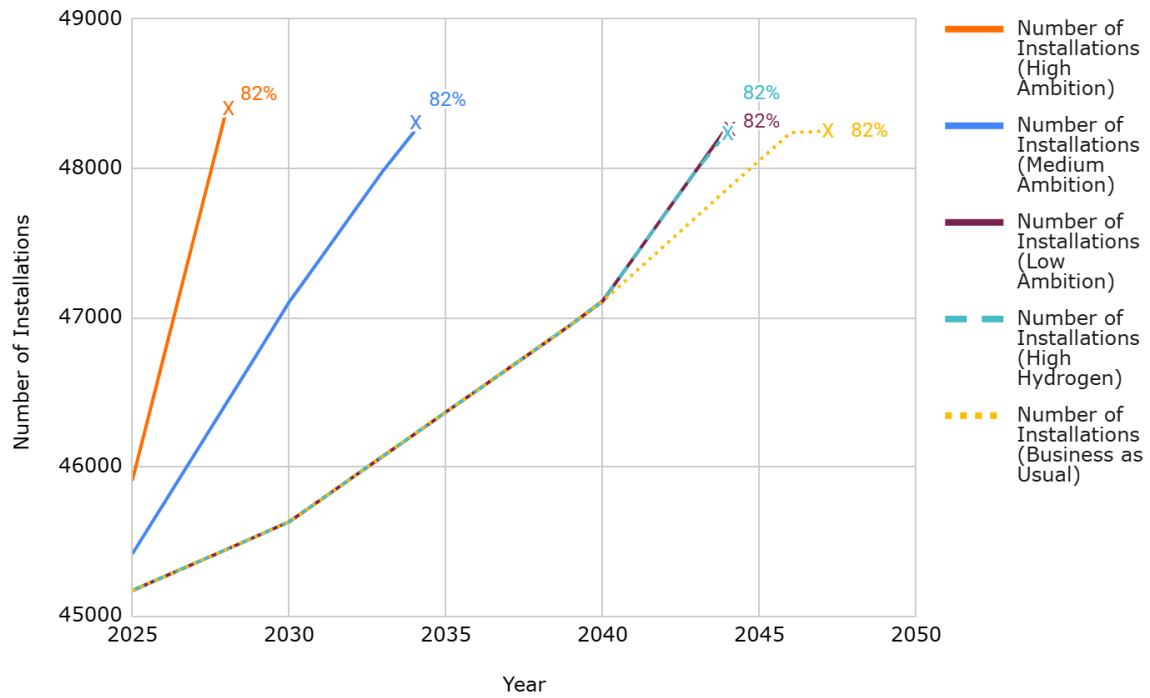


Figure 11: Deployment rates of loft insulation across scenario pathways.

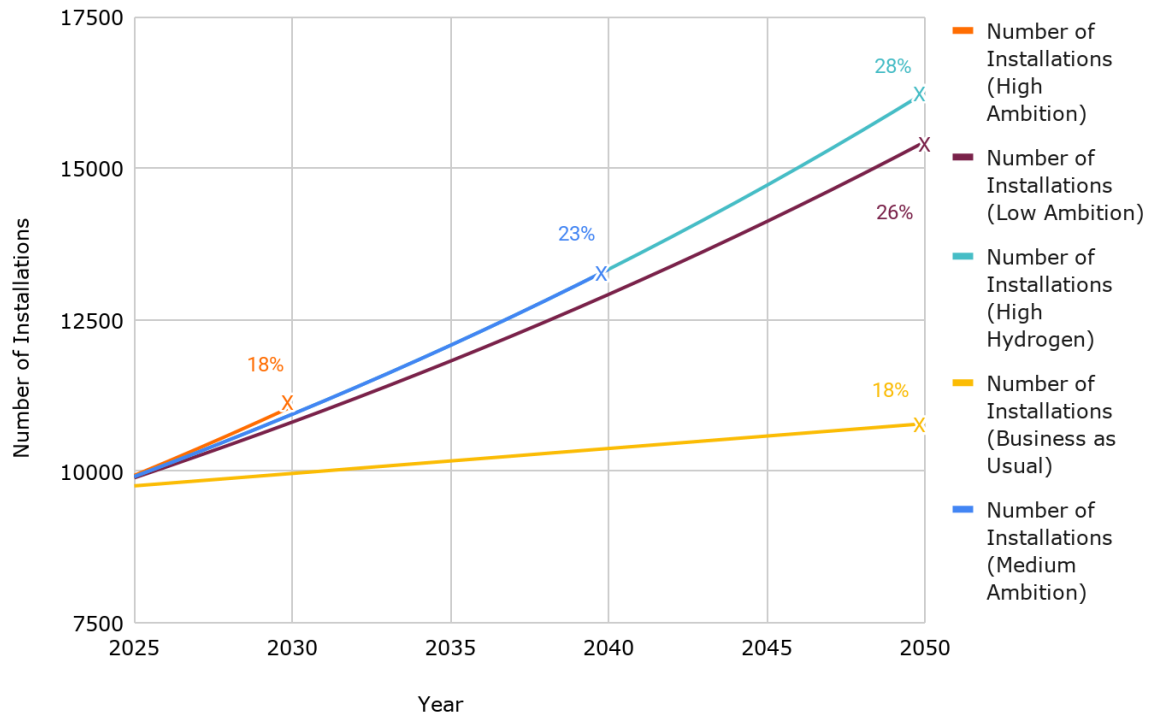


Figure 12: Deployment rates of under floor insulation across scenario pathways.

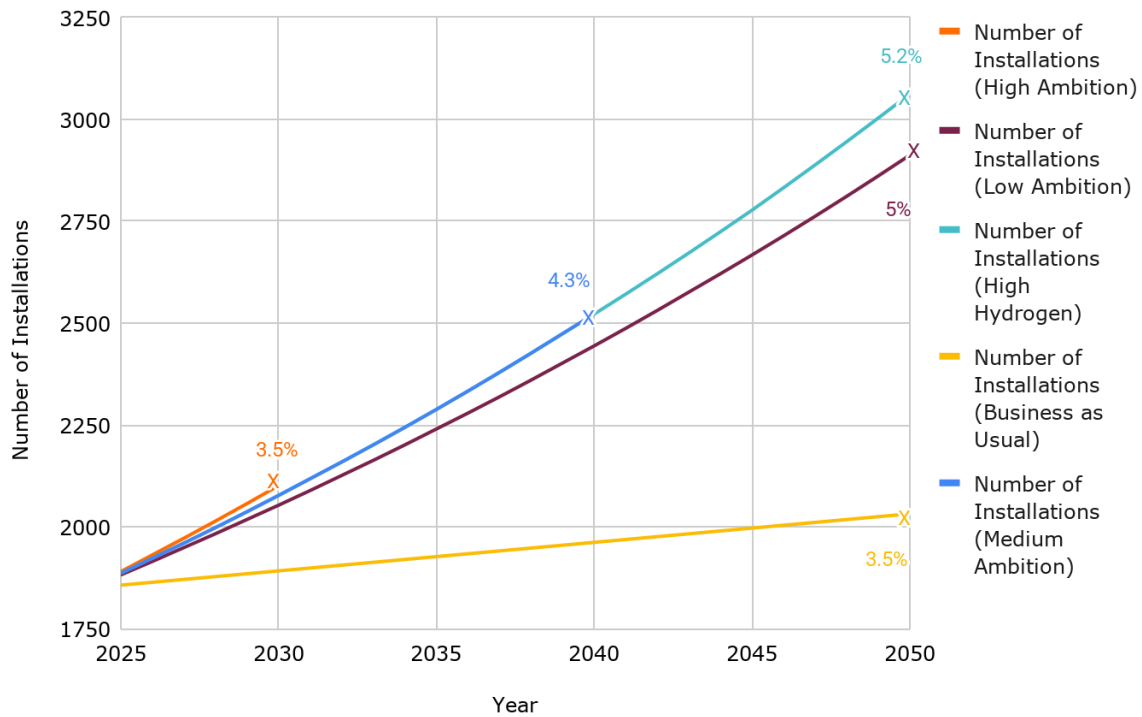


Figure 13: Deployment rates of external wall insulation across scenario pathways.

Overall, all scenario outputs prioritise wall and loft insulation as these deliver some of the greatest improvements to energy efficiency and lower consumer bills. Figure 14 outlines the geographic spread of new and existing insulation installations. This is reflective of potential for new installations as well as possible deployment trends. Aside from council-owned housing, most decisions will rest with property owners across Winchester. Where EPC data includes tenure, many homes in Winchester (21,673) are reported to be owner-occupied, meaning residents themselves control decisions about retrofit and other home upgrades which is likely to support an uptake rate slightly faster than the national average. Although it should be noted that a large proportion of homes (23,623) have unknown tenure which might affect this.

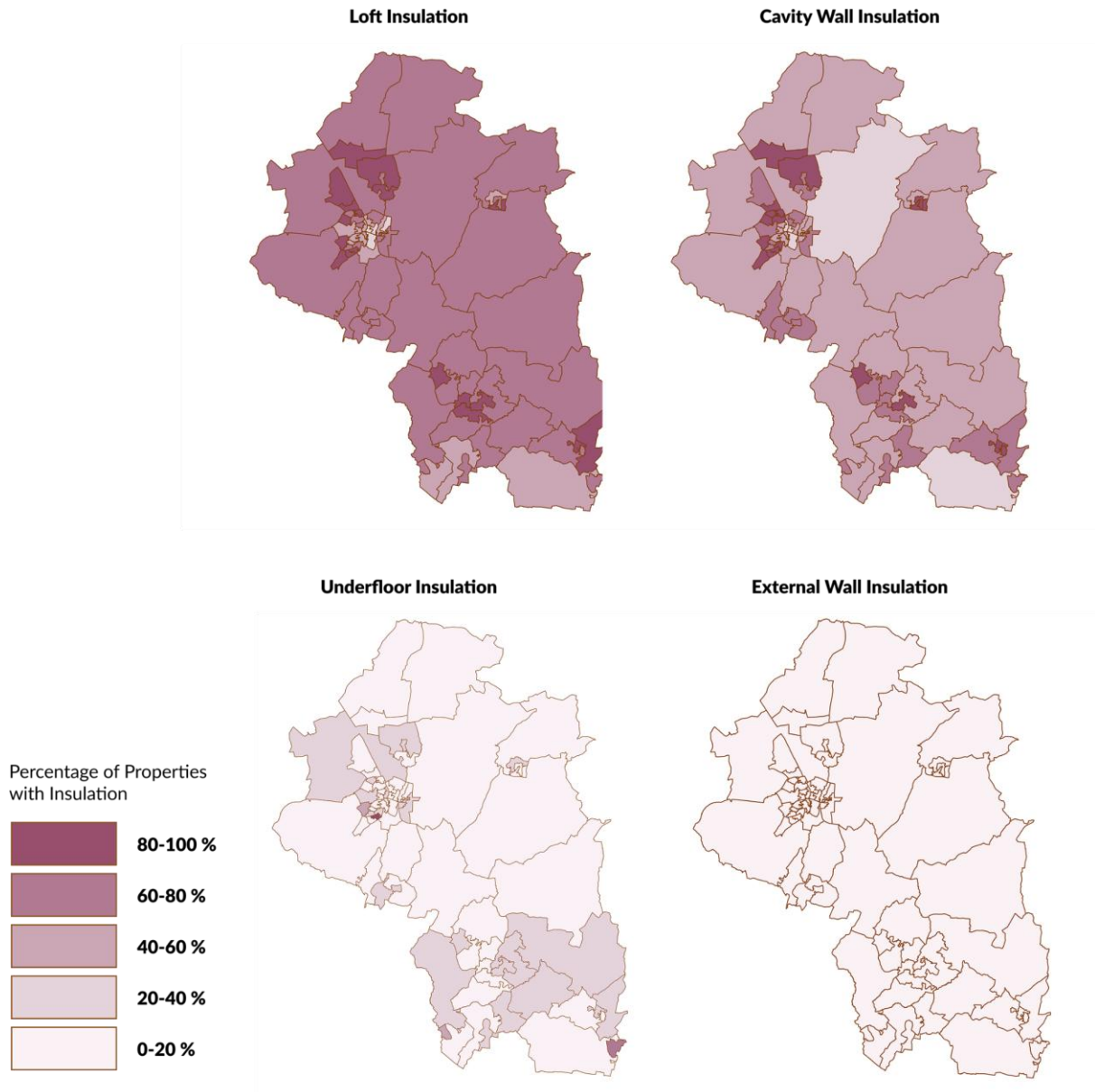


Figure 14: Percentage of homes insulated by 2040 in the Medium Ambition Pathway), by LSOA (includes existing insulation).

4.1.3 Heating

Substantial growth in lower carbon heating technologies is required across Winchester to support a transition toward a Net Zero energy system. Across all scenarios, heat decarbonisation accelerates significantly from the early 2030s, reflecting national policy timelines, improved technology performance, and increasing market readiness. Unlike established energy efficiency measures like insulation, heat pump deployment varies significantly across scenarios, depending on the ambition and pathway explored, with the lowest potential uptake seen in the “Business as Usual” and “High Hydrogen” scenarios.

Air Source Heat Pumps

Air Source Heat Pumps (ASHP) represents a dominant low-carbon heating option for Winchester, consistent with national deployment trajectories. Under the Medium Ambition pathway, total installations (existing + new) increase steadily to 32,455 by 2040, while in the Low Ambition scenarios sees more staggered growth across a longer timeframe toward 2050, reaching approximately 32,182 installations.

The High Ambition 2030 scenario demonstrates an early and rapid uptake, achieving 9604 installations by 2030. In the High Hydrogen pathway: off-gas properties and properties that are more economically suited to Air Source Heat Pumps transition to ASHPs. The remaining properties in this scenario, which assumes centralised backing for hydrogen in domestic and non-domestic sphere, transition to hydrogen-based heating from the mid-2030s onwards.

Non-domestic ASHP uptake remains modest across all pathways, reflecting the smaller non-domestic building stock and small existing uptake. Even in the High Ambition 2030 scenario, installations rise only slightly by 2030, with Medium and Low Ambition pathways showing gradual, incremental growth through to 2050. The High Hydrogen pathway follows a similar trajectory, indicating that hydrogen availability does not significantly shift ASHP deployment in the non-domestic sector. Overall ASHPs serve as a central technology under electricity-led pathways.

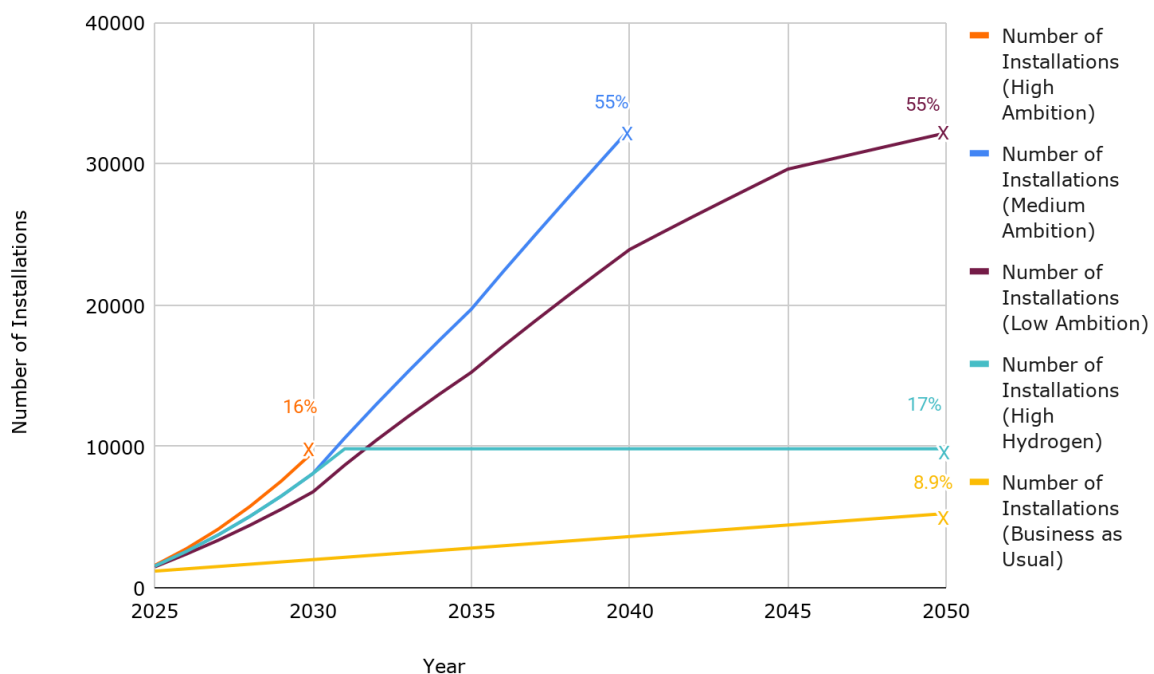


Figure 15: Deployment rate of domestic air source heat pump installations across all scenarios pathways.

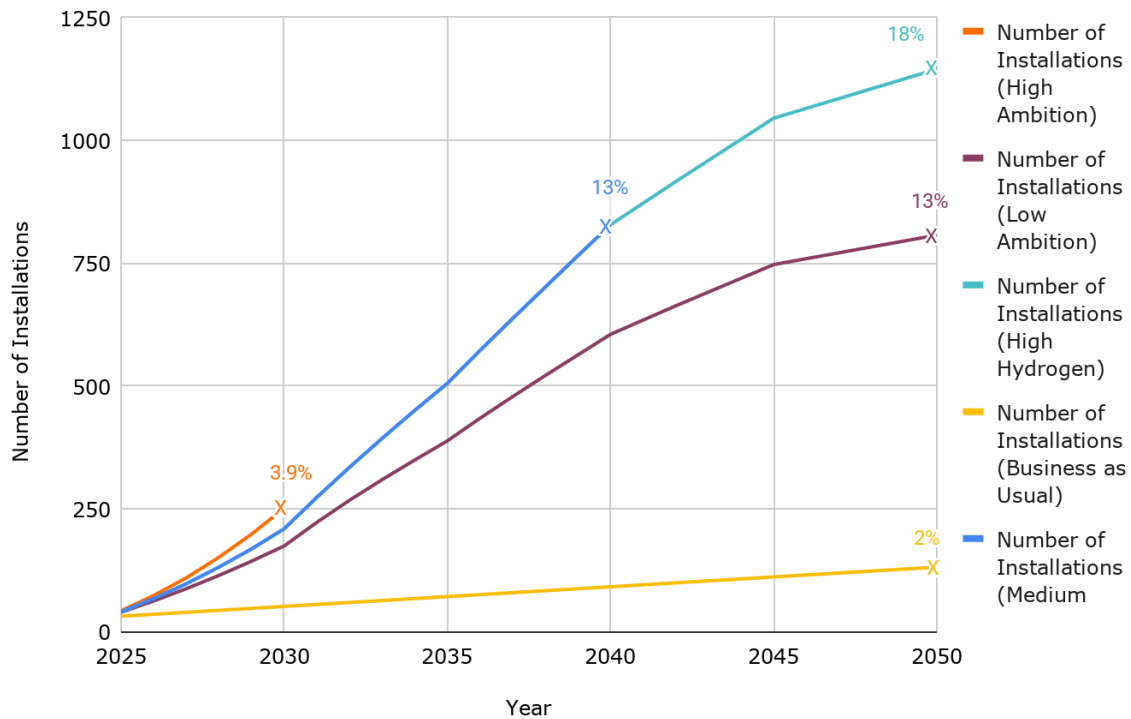


Figure 16: Deployment rate of non-domestic air source heat pump installations across all scenario pathways.

Ground Source Heat Pumps

Ground Source Heat Pump (GSHP) uptake is limited compared to ASHPs due to higher installation costs and property suitability constraints in Winchester. For example, 90% of domestic properties are suitable for an Air Source Heat Pump, whilst 35% are suitable for a standard Ground Source Heat Pump. Nevertheless, GSHPs form a valuable part of Winchester's long-term heating decarbonisation mix, particularly in areas where ground conditions and garden space support efficient operation. By 2050, domestic GSHP installations reach around 1440 units in the Low Ambition scenario and 376 in the High Hydrogen pathway, with 1,453 units installed by 2040 in the Medium Ambition pathway. Non-domestic GSHP deployment is very consistent across all scenarios reflecting strong potential for these, albeit in a smaller number of buildings

Although overall deployment remains modest, GSHPs offer system benefits relative to ASHPs; their higher efficiency (COP - Coefficient of Performance) results in lower peak electrical load for each unit of heat delivered. However, like all electrified heating technologies, GSHP adoption still increases total electricity demand when replacing gas boilers. Early uptake is most pronounced in the High Ambition pathway, with growth in other scenarios developing more gradually toward 2050.

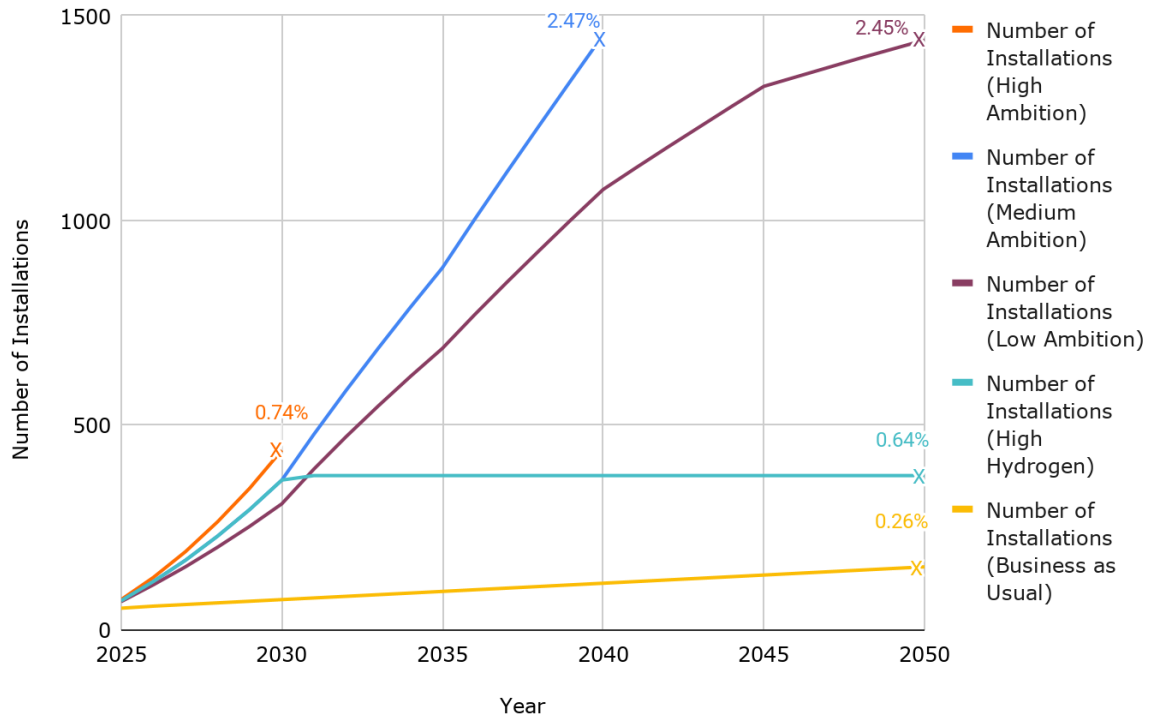


Figure 17: Deployment rate of domestic ground source heat pump installations across all scenario pathways.

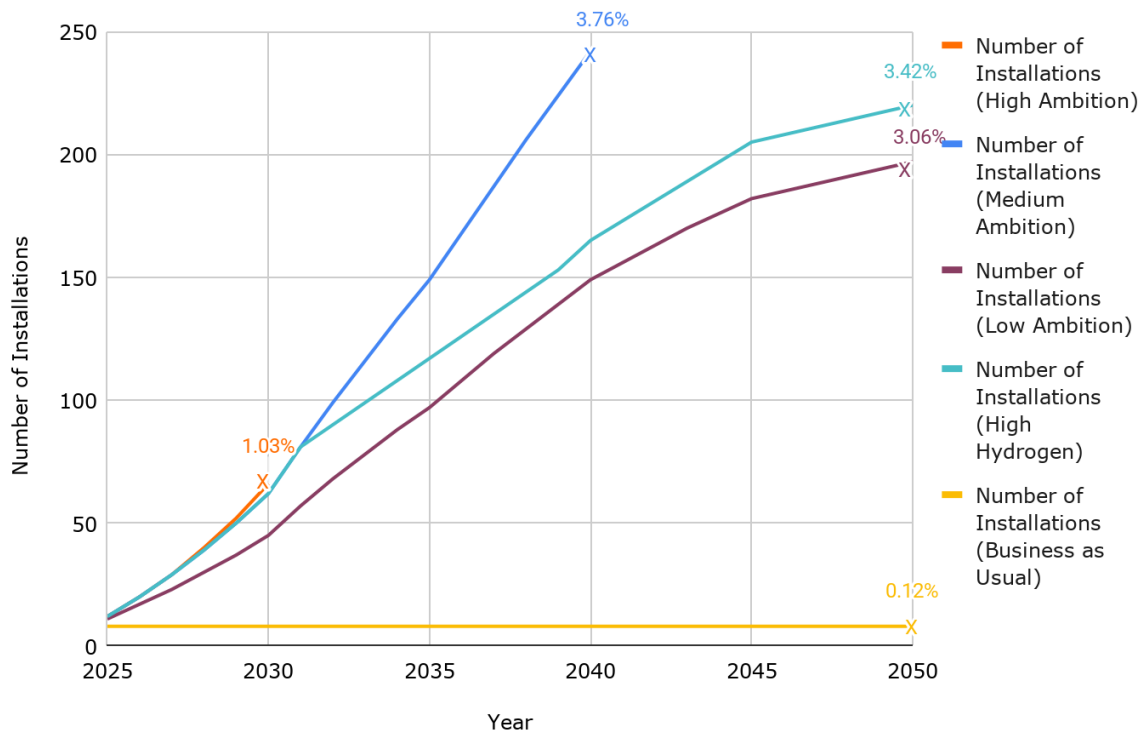


Figure 18: Deployment rate of non-domestic ground source heat pump installations across all scenario pathways.

Communal and District Heat Networks

Winchester has some opportunity for district and communal heating (Figure 19) across all scenarios which can supplement other dominant heating technologies, such as heat pumps. Combined these zones represent approximately 96.89 MW networked peak heat demand and 221 GWh/year networked annual heat demand. Although not all properties within a zone will be suitable for connection, these zones can supply a significant proportion of domestic and non-domestic properties within the zones.

As heat networks appear across all scenarios, these are identified as 'low regrets' projects with significant emissions reduction potential and the lowest cost route for suitable buildings in these regions. However, the development of such zones is likely to be heavily dependent on local as well as national decision makers which adds some uncertainty to projections, especially for earlier (2030 and 2040) scenarios. Unlike heat pumps, which are installed building by building, heat networks are deployed zone by zone. This means deployment rates for heat networks see a stepped progression as buildings transition in bulk as defined zones are turned on (see Figure 19).

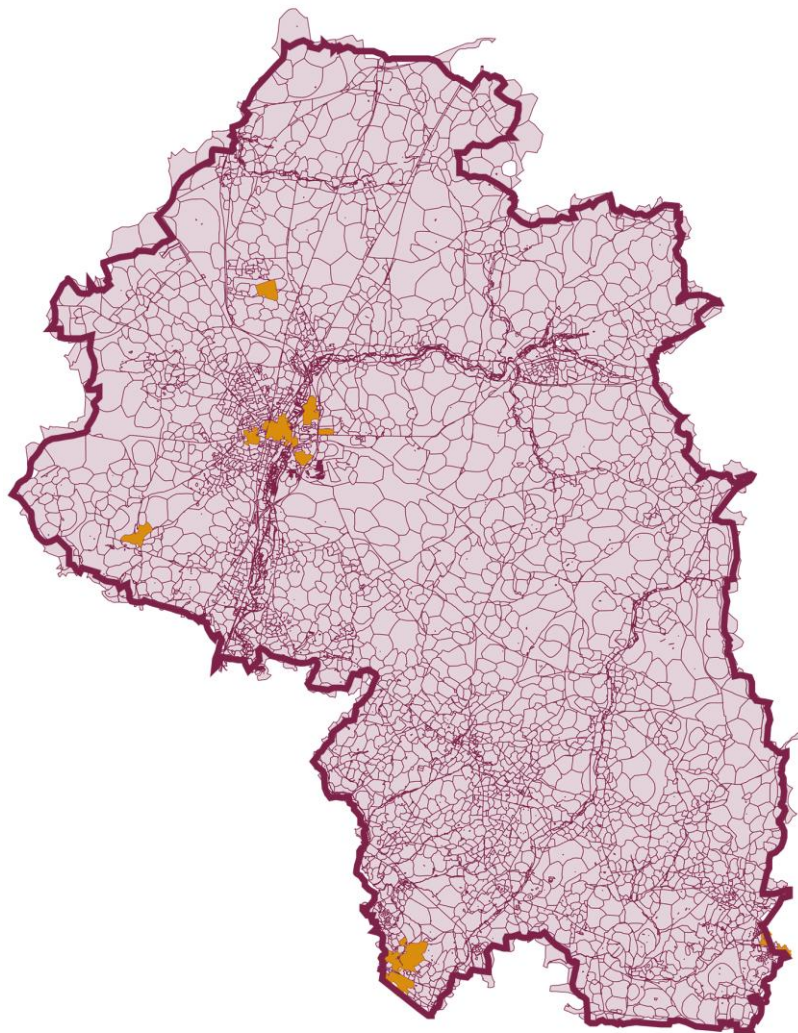


Figure 19: Heat network zoning in Winchester, (Department for Energy Security and Net Zero).

A total of 3,949 domestic properties fall within the potential heat network zones across all pathways, representing the full set of homes assessed as suitable for connection. In the High Ambition scenario, all of these units are connected rapidly within the first five-year period, highlighting a near-term opportunity for accelerating heat decarbonisation in the district. However, achieving this pace of delivery would require substantial early-stage development and coordinated investment, and may be challenging without heat network projects already in progress. In the Medium Ambition, Low Ambition and High

Hydrogen scenarios, the same 3,949 connections are delivered more gradually, with deployment spread over a longer timeframe.

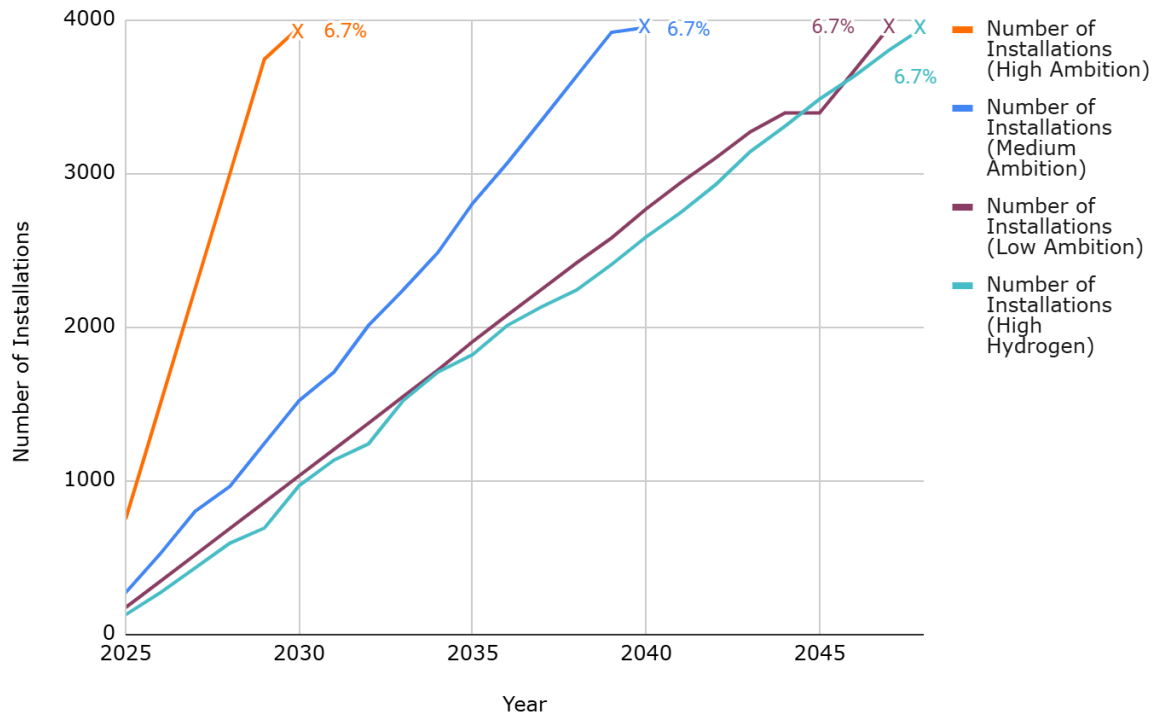


Figure 20: Deployment rate of domestic Heat Network connections across all scenario pathways.

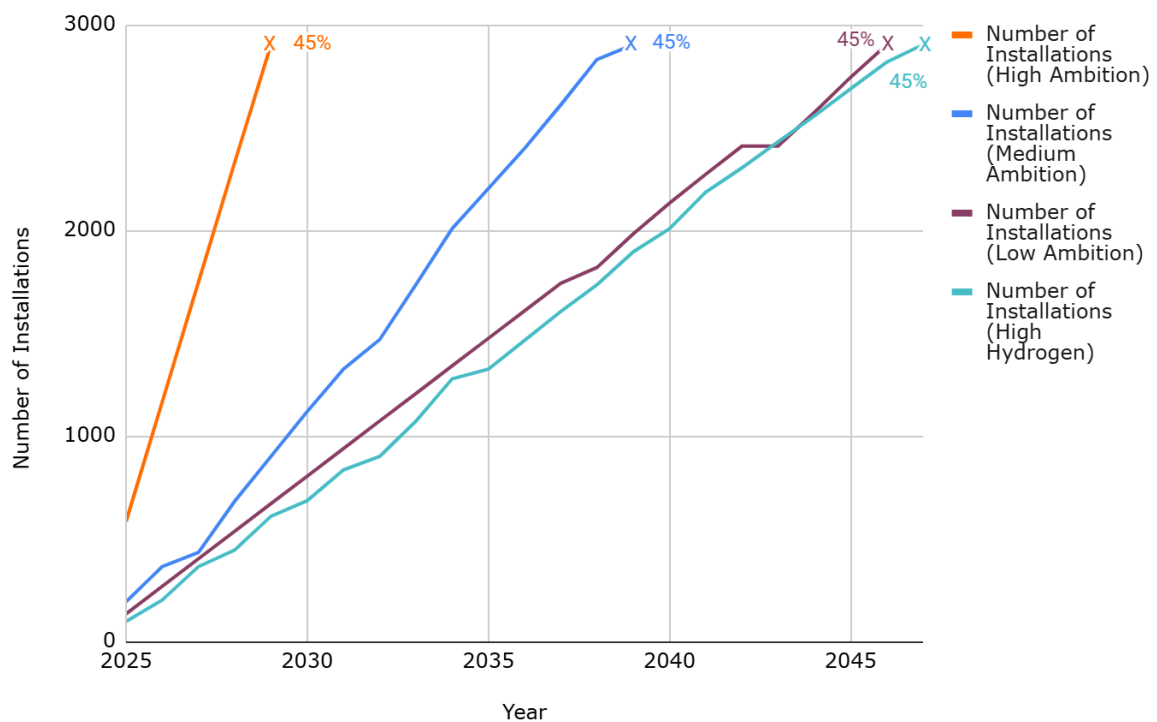


Figure 21: Deployment rate of non-domestic Heat Network connections across all scenario pathways. A total of 2,903 non-domestic properties are identified as suitable for heat network connection, and all

pathways (other than Business as Usual) ultimately achieve full connection of this 2,903 by their respective end years. The High Ambition pathway delivers the most rapid progress, reaching full connection by 2030 and demonstrating the scale of near-term opportunity available if investment and enabling conditions are prioritised. Medium Ambition follows a more measured trajectory, while the High Hydrogen and Low Ambitions pathway reaches shows only limited progress by 2030 but continues to grow steadily thereafter. Across all scenarios, the trajectories highlight that non-domestic heat network deployment is highly sensitive to the level of ambition and policy support. While full connection is technically achievable in every pathway except Business as Usual, the pace of delivery varies substantially, underscoring the importance of early action to capture carbon-reduction benefits sooner.

Hydrogen Boilers

Hydrogen offers potential benefits as a heating solution but is the most uncertain of all possible pathways. In theory, hydrogen distribution can utilise existing gas network infrastructure once upgraded sufficiently, this avoids additional load on electricity distribution networks and provides an alternative for properties where heat pump installation may be challenging. However, significant uncertainties remain around feasibility (especially for domestic heating), hydrogen production costs, carbon intensity of production methods, network conversion timelines, and technology readiness. The viability of hydrogen heating at scale depends on national-level decisions regarding production infrastructure and gas network conversion strategies, which remain under active policy development.

Hydrogen is considered only in the High Hydrogen scenario for domestic and non-domestic properties, where it is assumed to become available from 2035 onwards. All other scenarios assume no significant hydrogen availability given limited industrial hubs in Winchester. Following a decision on hydrogen, it will take time to ensure the existing gas network is hydrogen suitable and to replace existing boilers with those suited for blended or 100% hydrogen. SGN has begun upgrades to the gas network and 84% of the low-pressure network in Winchester has already been replaced with “hydrogen ready” polyethylene material. However, some work is likely to remain by the 2030s. This is reflected in the later uptake shown in the graphs.

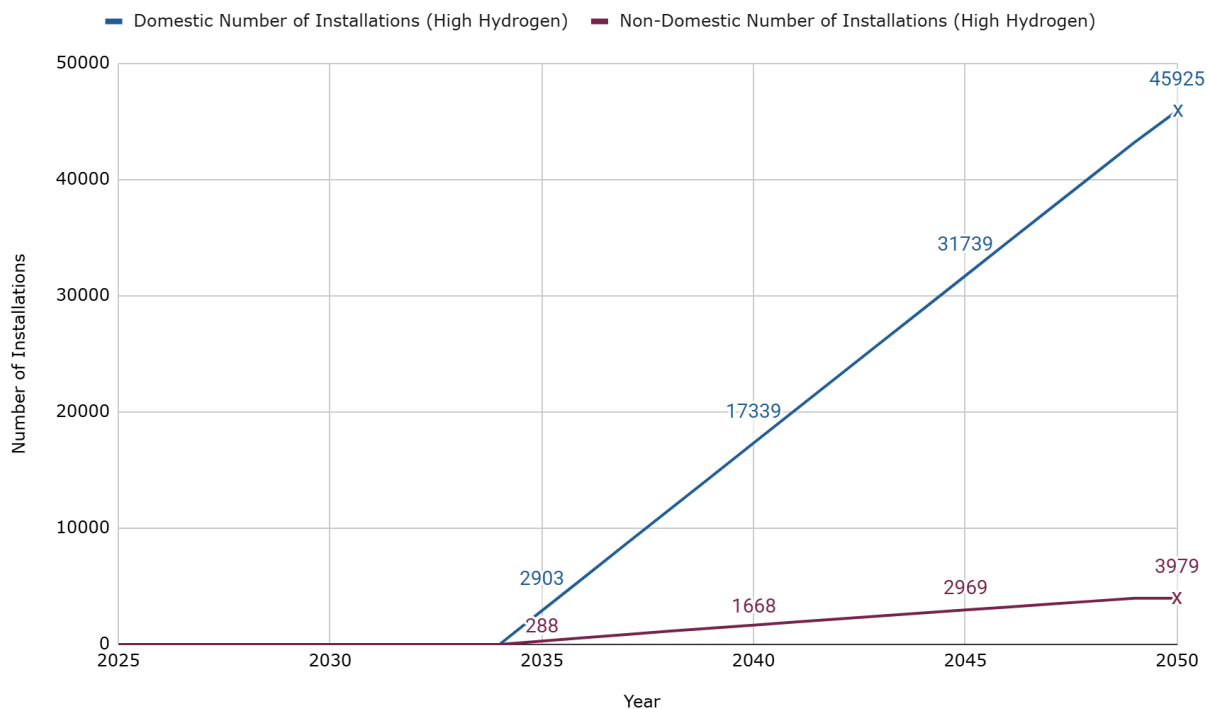


Figure 22: Deployment rates of domestic and non-domestic hydrogen boilers under the High Hydrogen scenario pathway.

Winchester has an established gas network infrastructure serving ~78% of homes. Under the High Hydrogen scenarios uptake is concentrated in areas currently connected to the gas grid, reflecting the infrastructure-led nature of hydrogen deployment. Rather than individual households switching independently, the model assumes zone-by-zone conversion, where clusters of neighbouring properties transition together. This clustering reflects the characteristics of local building stock and the infrastructure assumptions applied to dense urban areas. This coordinated approach is consistent with how gas network operators are expected to manage hydrogen conversion, prioritising contiguous blocks of buildings to minimise disruption, maintain network integrity, and achieve cost efficiencies.

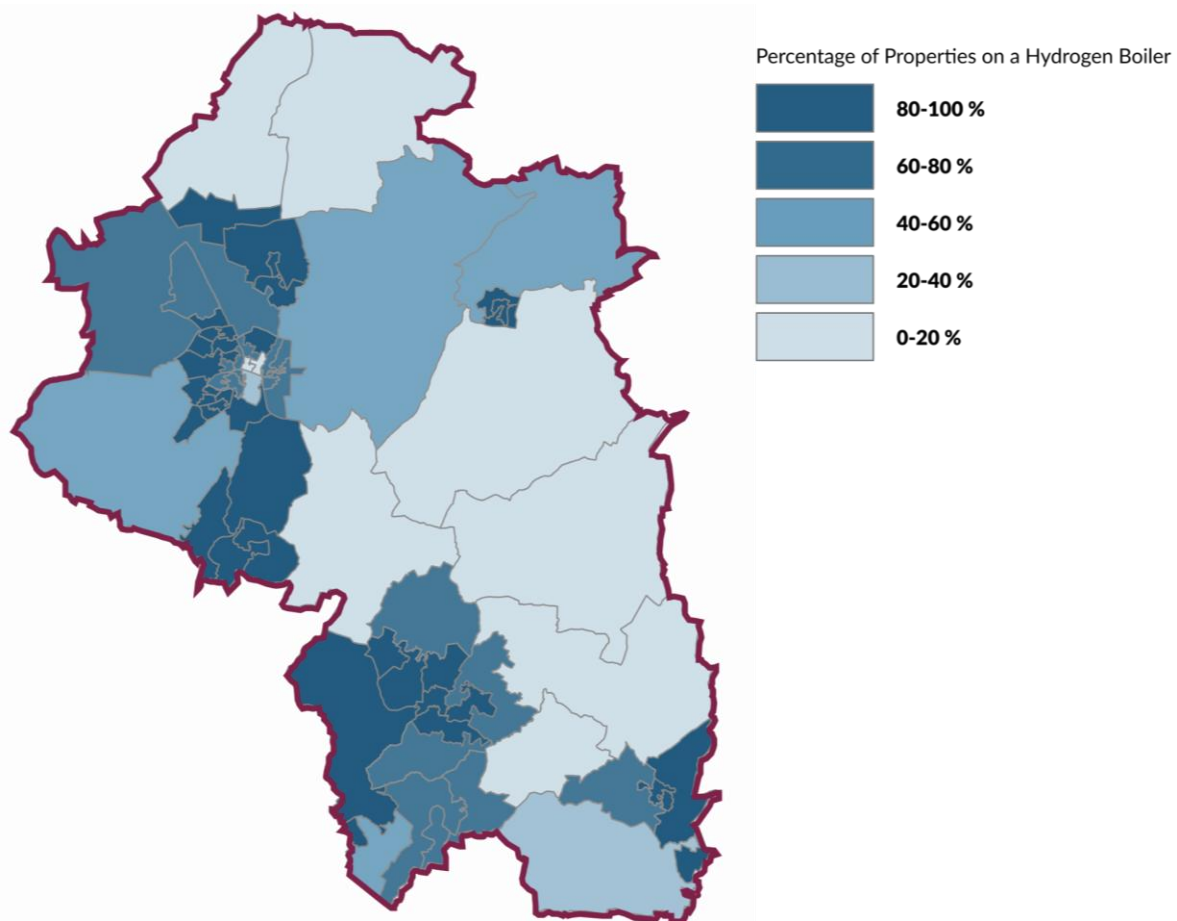


Figure 23: Percentage of domestic and non-domestic buildings with a hydrogen boiler by 2050 in the High Hydrogen Scenario.

As these zones become eligible for conversion after 2035, households within them begin adopting hydrogen-ready heating systems. This gradually reduces the level of electrification required across the area, since a share of properties that would otherwise utilise electric heating technologies move instead to hydrogen-based heating. The impact is visible in the modelling outcomes: the High Hydrogen pathway shows noticeably flatter growth in ASHP and GSHP installations from the mid-2030s, as hydrogen uptake absorbs part of the heating demand in areas connected to the gas network. Meanwhile off-gas homes move onto other technologies, predominantly heat pumps.

Alternative Electric Heating Technologies

Alternative electric heating technologies, such as resistive heating, are less efficient but sometimes more suitable for properties that are difficult to decarbonise or where the upfront costs of heat pumps are prohibitive. At present about 9% of UK homes use alternative electric heating technologies, such as storage heaters, exceeding the proportion using heat pumps.

These properties typically face challenges with heat pumps, district heating, or hydrogen due to various factors such as the building's age, structure, available space, location, or insulation. Upfront costs for heat pumps are also generally higher than alternatives, making alternative electric heating technologies a more attractive option for some homeowners - especially in scenarios that assume a faster transition away from high carbon fuel sources like gas.

Alternative technologies are utilised most heavily in the Medium Ambition scenario due to the earlier end date of 2040. This rapid uptake is driven partly by the high upfront cost of technology like heat pumps (at present), as well as challenges facing harder-to-decarbonise areas and older buildings where the infrastructure for heat pumps may not be feasible or cost-effective to install within the given timeframe.

Across other scenarios, alternative heating technology deployment is variable:

- The High Ambition scenario assumes only a very slight increase in alternative heating technologies by 2030, in line with current installation trends for Winchester. Low short-term uptake is influenced by things like the high cost of electricity and the Boiler Upgrade Scheme (BUS), which offers £7,500 grants towards heat pump installations. This is expected to incentivise consumers willing and able to adopt electric heating technologies towards heat pumps.
- The Low Ambition scenario assumes a higher number of homes are able to transition onto standard heat pumps and there is less need for alternative solutions. This is driven by a reduction in the cost of heat pumps, improvements in the technology which support faster update as well as schemes incentivising heat pumps - such as the BUS.
- In the High Hydrogen scenario, alternative technologies have minimal rollout as this scenario assumes all on-gas properties transition to hydrogen.

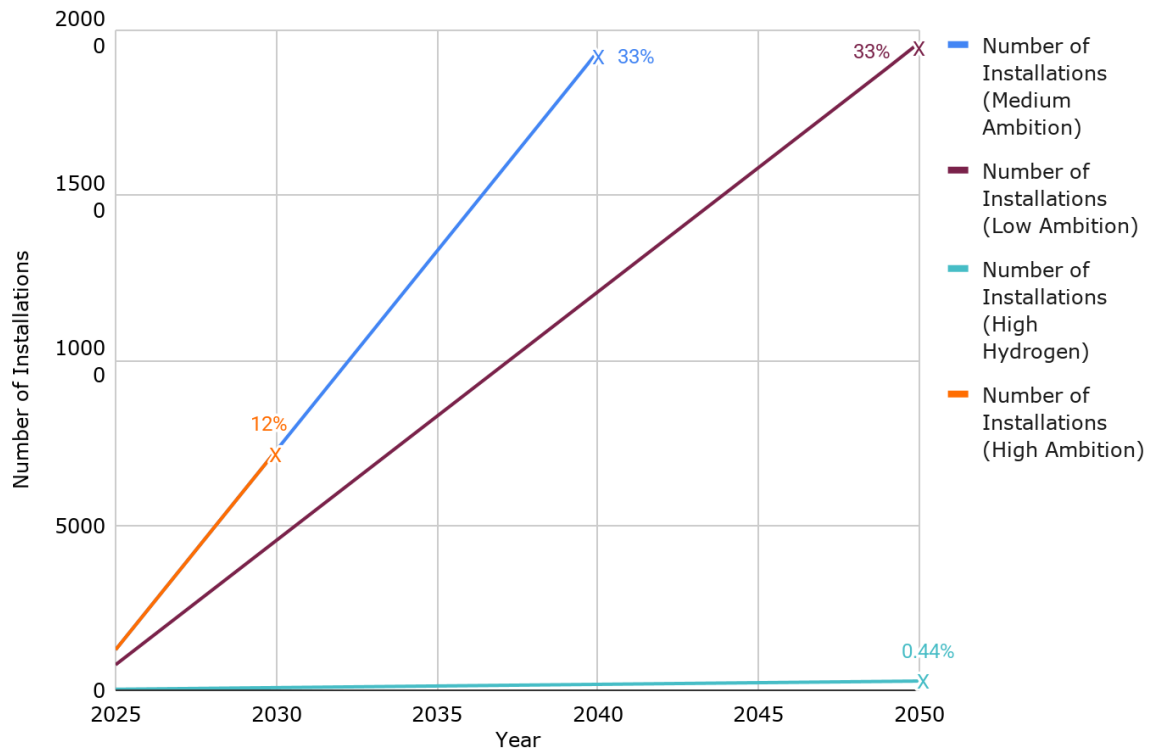


Figure 24: Deployment rate of new domestic alternative electric heating technologies across all applicable scenario pathways.

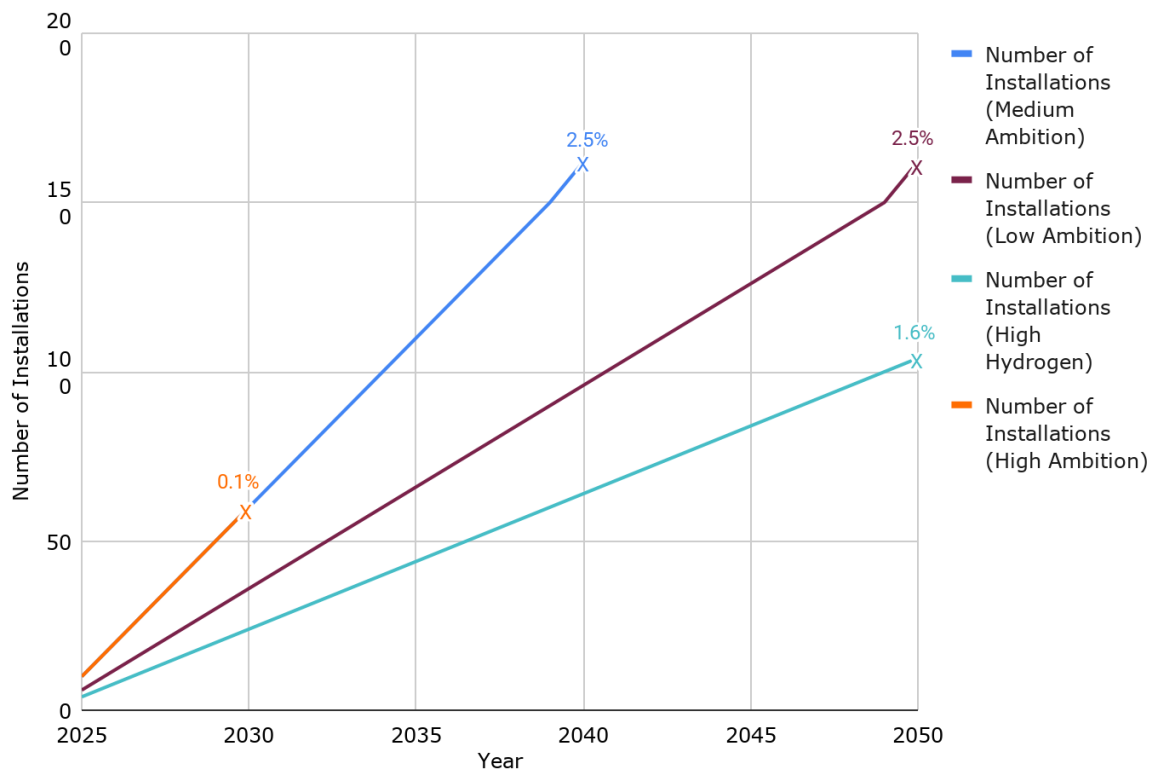


Figure 25: Deployment rate of new non-domestic alternative electric heating technologies across all applicable scenario pathways.

4.1.4 Rooftop PV

Rooftop solar photovoltaic (PV) systems represent a significant opportunity for Winchester to decarbonise its energy supply by utilising the existing built environment. The Local Area Energy Plan identifies high suitability for this technology across the district (~75% of domestic and non-domestic building stock), with modelling suggesting that rooftop PV can play a substantial role in reducing electricity-related emissions. The deployment trajectories for this technology, however, vary significantly between domestic and non-domestic sectors, influenced by different economic drivers, policy timelines, and the physical characteristics of the building stock. Winchester has already made significant progress, with a combined total of 5,663 domestic and non-domestic buildings now hosting solar PV installations.

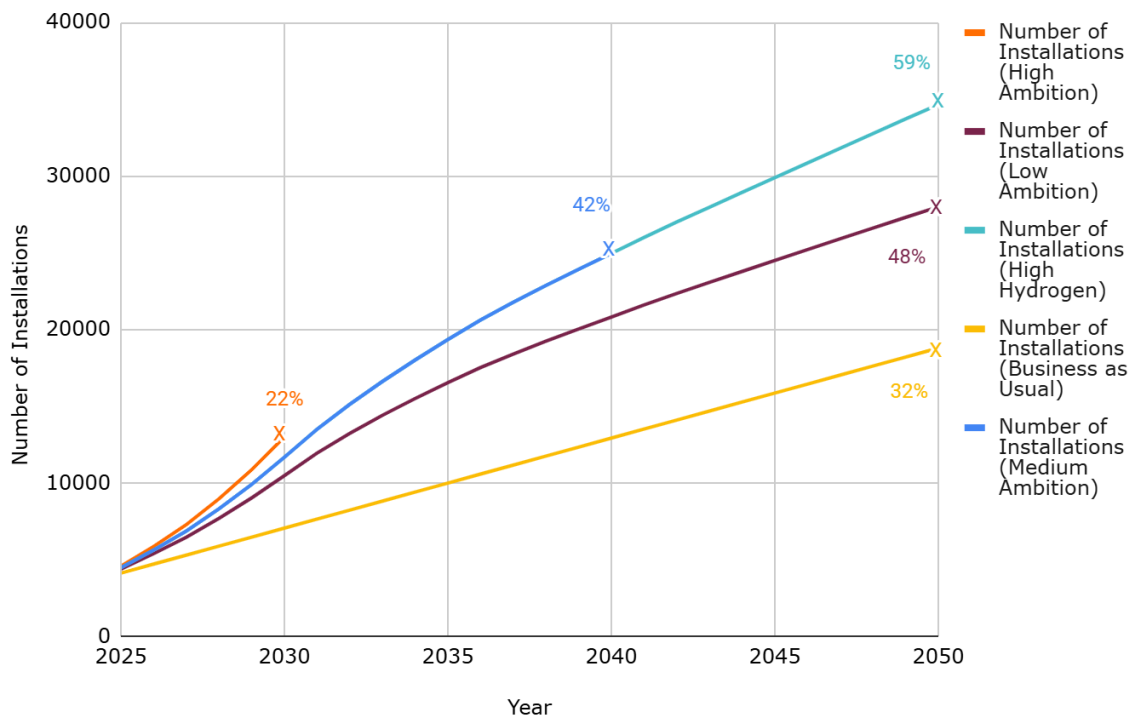


Figure 26: Deployment rate of domestic rooftop PV connections across all scenarios pathways.

The modelling results for domestic rooftop PV, illustrated in the figures above, reveal a complex relationship between ambition levels and deployment rates. Contrary to the expectation that a higher ambition may yield the highest immediate volume, the High Ambition scenario reaches 13,021 installations. This represents a penetration rate of approximately 22%, which is lower than the long-term potential realised in other scenarios. This level of PV uptake reflects the practical limits on how quickly rooftop systems can scale beyond Winchester's current deployment rate within the five-year window to 2030.

The Medium Ambition pathway shows potential for continued growth, reaching around 24,964 installations by 2040 - bringing PV coverage to roughly 42% of Winchester's domestic properties. The Low Ambition and High Hydrogen pathways, ending in 2050, deliver the highest overall uptake - this represents a substantial long-term opportunity for the district, demonstrating how sustained deployment over an extended period can deliver meaningful progress toward the area's ambitions.

In contrast, the Business-as-Usual scenario projects a steady, linear growth of 15,235 new installations by 2050 without additional intervention. This figure indicates that market forces will naturally drive substantial adoption. However, the significant gap between the "Business as Usual" baseline and the "Low Ambition" potential highlights that long-term policy support is needed to unlock the full potential of Winchester's housing stock.

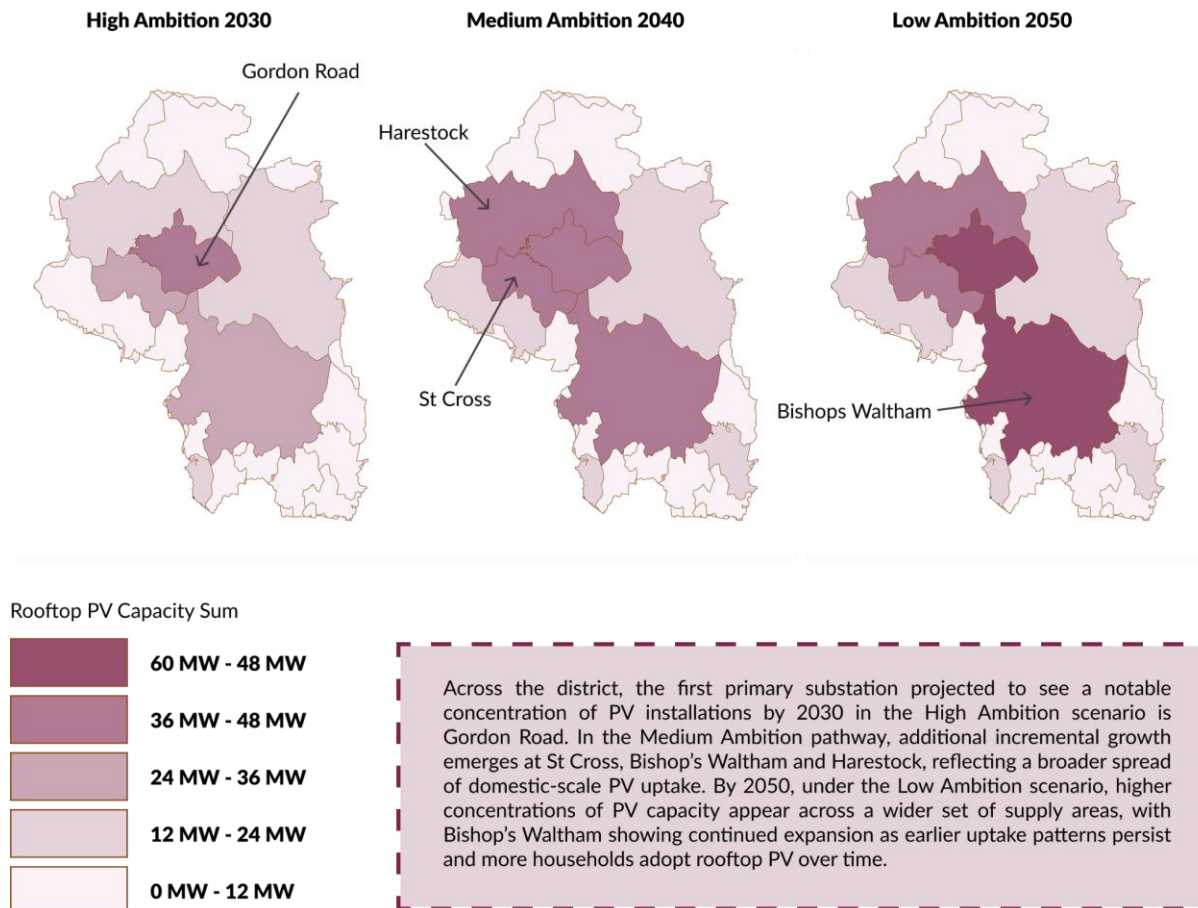


Figure 27: Capacity of newly deployed Domestic and Non-Domestic PV across High Ambition, Medium Ambition and Low Ambition Scenarios.

In the non-domestic sector, the modelling shows a strong convergence across all pathways, with each scenario ultimately reaching ~5,000 installations. The main difference lies in the pace of rollout. This consistency indicates that commercial rooftop PV is a robust, market-driven opportunity. Crucially for Winchester, this creates a clear near-term opportunity: because the stock of suitable non-domestic buildings is relatively fixed and already well-aligned with PV deployment, the district can move rapidly toward saturation within the next five years. Even in the Business-as-Usual pathway, a large proportion of suitable properties eventually receive installations, as the high suitability of non domestic properties and the relatively small number of feasible sites allow deployment to progress steadily over a longer timeframe. This is why the Business-as-Usual and Low Ambition pathways ultimately converge, despite differing ambition levels. Overall, non-domestic PV remains one of the most immediate and achievable wins in the wider energy transition - an area where early action can deliver visible progress while domestic deployment scales over a longer period.

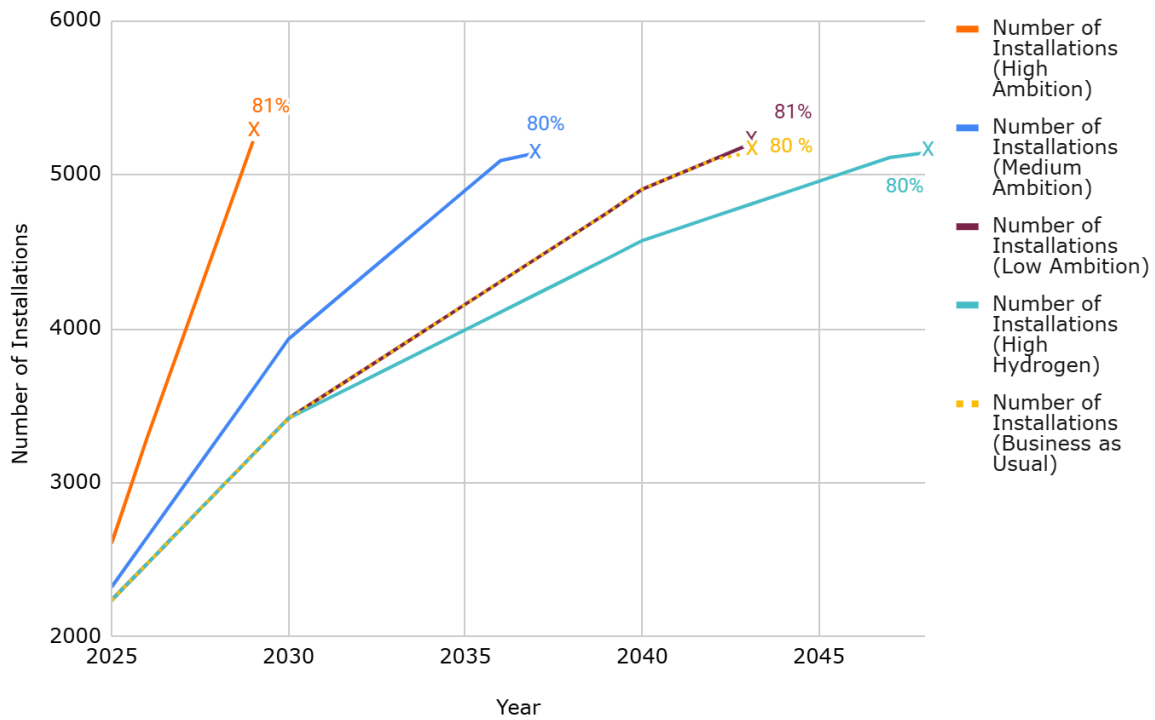


Figure 28: Deployment rate of non-domestic rooftop PV installations across all scenario pathways.

4.1.5 Rooftop PV Storage

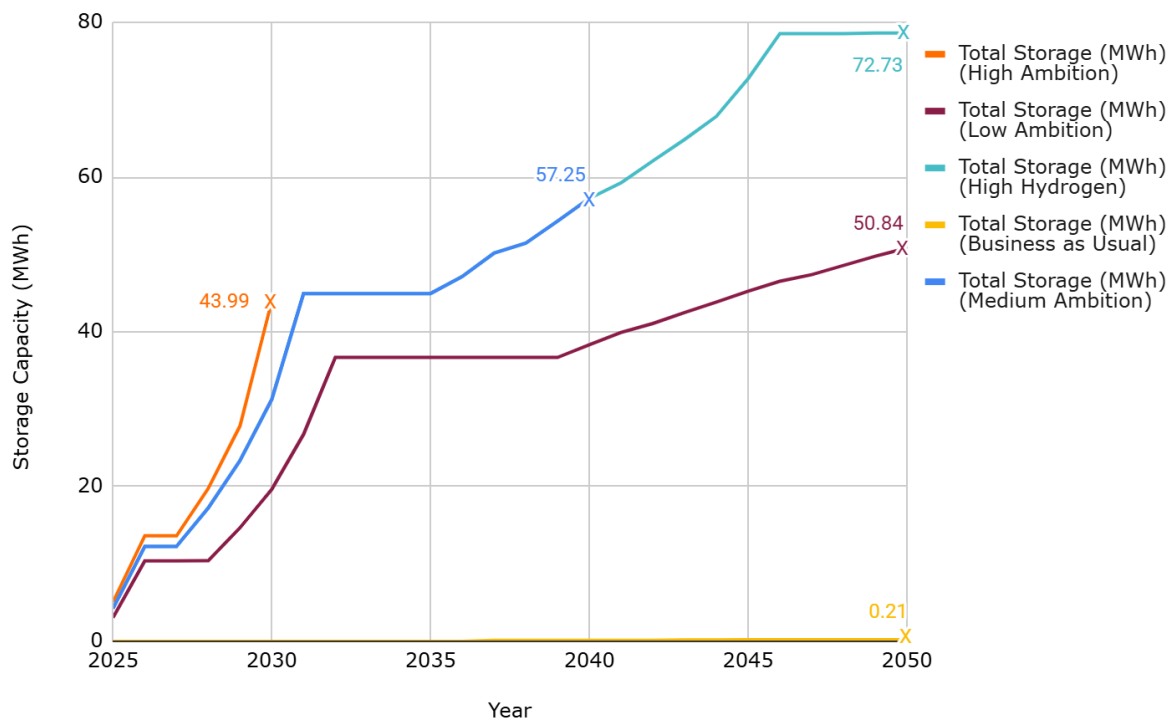


Figure 29: Deployment rate of new domestic rooftop PV storage connections across all scenarios pathways.

This LAEP has also modelling the colocation of storage with rooftop PV installations (described as ‘domestic rooftop storage’). Domestic rooftop storage deployment also varies significantly by scenario, reflecting differing levels of PV uptake and policy intervention. Under the ‘Business as Usual’ scenario, storage growth is minimal, reaching only 0.21 MWh by 2050, driven solely by natural PV adoption. This provides the lowest overall contribution to local flexibility. In contrast, High Ambition – 2030 delivers an early step-change, reaching 43 MWh by 2030. Medium Ambition – 2040 continues this momentum, achieving 57 MWh by 2040 and Low Ambition achieving slightly less at 50 MWh. The difference between the ‘Business as Usual’ and more interventionist proactive pathways highlights the importance of policy support: Medium Ambition delivers nearly six times more storage capacity by 2050. Overall, consistent PV deployment policies significantly enhance local storage capacity and provide greater flexibility to support future electrification.

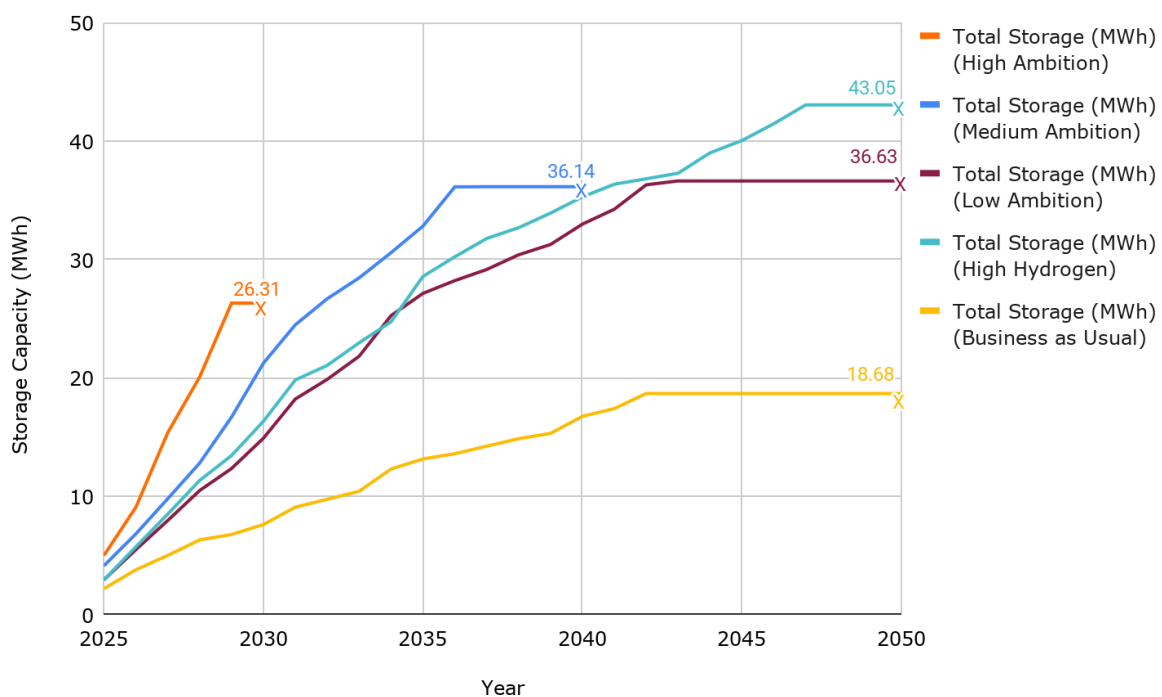


Figure 30: Deployment Rate of new non-domestic rooftop PV storage connections across all scenario pathways.

Non-domestic rooftop storage deployment shows more divergence across scenarios, reflecting differing levels of commercial PV uptake and investment incentives. Under the ‘Business as Usual’ scenario, storage deployment grows gradually, reaching 18.7 MWh by 2050. This represents the lowest overall capacity and indicates limited uptake without targeted policy or financial drivers. Higher-ambition scenarios deliver materially stronger outcomes. High Ambition – 2030 reaches 26 MWh by 2030, while Medium Ambition – 2040 achieves 366 MWh by 2040, both illustrating accelerated early adoption relative to the ‘Business as Usual’ baseline. These outcomes suggest that commercial PV-storage deployment remains strong across both electrification-led and hydrogen-leaning pathways. The contrast between ‘Business as Usual’ (18.6 MWh) and the more proactive scenarios (up to 43 MWh) highlights the influence of policy ambition: even modest intervention results in significantly higher storage uptake.

4.1.6 New Build Properties

New-build properties are modelled separately, and they are assumed to comply with the Future Homes Standard (FHS) from 2027, which requires high energy-efficiency performance and low-carbon heating. Based on current government housing targets, an annual addition of 1,157 new homes results in around 30,082 installations of cavity and loft insulation by 2050 across all pathways. Air source heat pumps are also applied to new-builds, reflecting the FHS requirement for low-carbon heating from 2025 and the expected phase-out of new gas boiler connections by 2028. Rooftop PV is similarly modelled on new-build properties, with deployment following the same suitability-led approach shown in the graph below. Under Winchester's Local Plan (2020-2040), policy CN3, new homes must also comply with the ambitious standard (the LETI standard) which includes space heating demand target of less than 15 kWh/M2/yr and an Energy Use Intensity of less than 35 kWh/M2/yr.

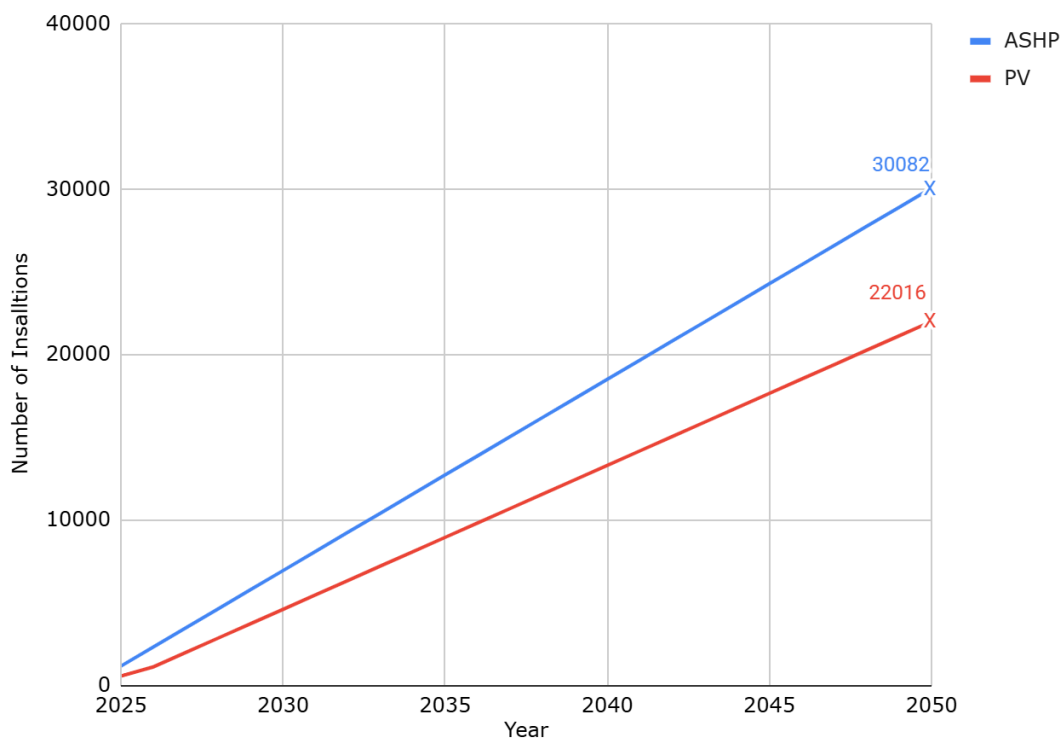


Figure 31: Deployment rates of cavity wall and loft insulation in new build properties.

4.1.7 Scale of Action to meet 2030 Targets

Meeting Winchester's 2030 low-carbon technology ambitions will require a significant acceleration in the deployment of domestic and non-domestic measures over the remainder of the decade. Across the domestic sector, the analysis indicates that approximately 123,000 additional installations are required between now and 2030 to meet adopted targets. This includes large-scale delivery of well-established insulation measures such as loft, cavity wall and under-floor insulation, alongside a rapid expansion of low-carbon heating and generation technologies. In particular, around 46,082 additional air source heat pumps, 31,756 rooftop PV systems, and almost 13,832 under-floor insulation measures are needed to reach target levels. While some measures such as loft and cavity wall insulation are already relatively mature, others - notably heat pumps - require a step change from a comparatively low existing baseline.

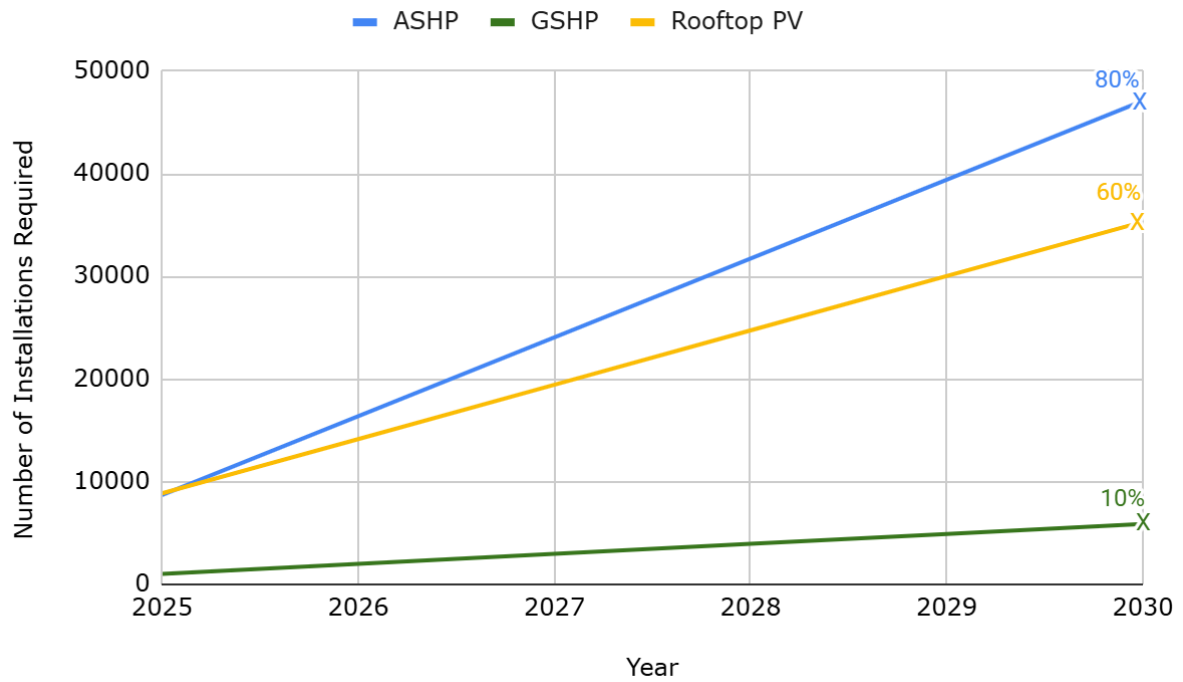


Figure 32: Projected scale of deployment of domestic technologies required to achieve 2030 targets.

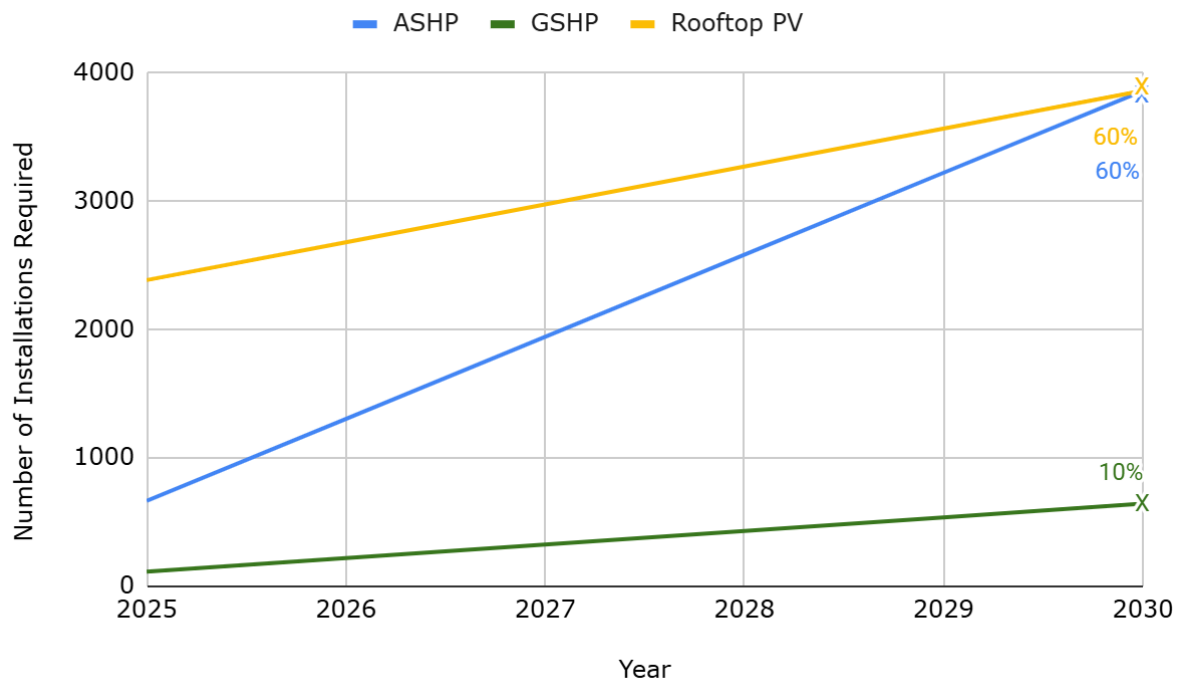


Figure 33: Projected scale of deployment non-domestic technologies required to achieve 2030 targets.

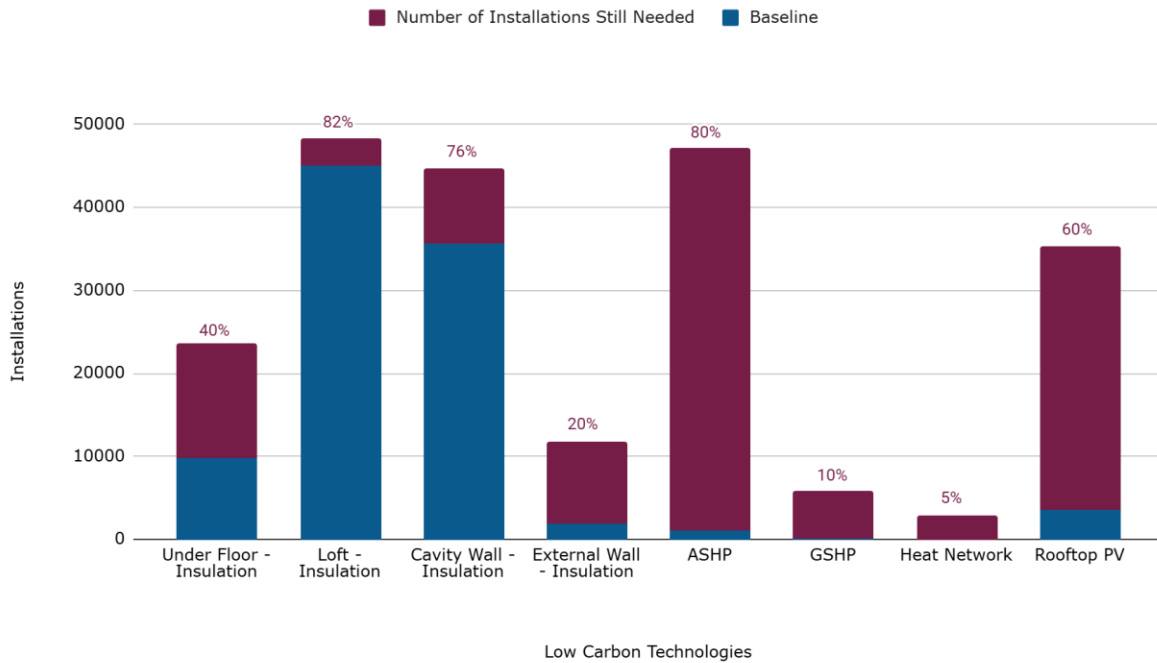


Figure 34: Domestic low carbon technology baseline (existing installations) compared against 2030 targets.

For non-domestic buildings, the absolute numbers are smaller, but the relative scale of change is comparable. Around 6,500 additional installations are required by 2030, dominated by air source heat pumps (3,836) and rooftop PV (1771), alongside early-stage deployment of heat networks and ground source heat pumps. Given the very low historic deployment of some of these technologies in the commercial and public estate, this represents a need for rapid transition rather than incremental growth.

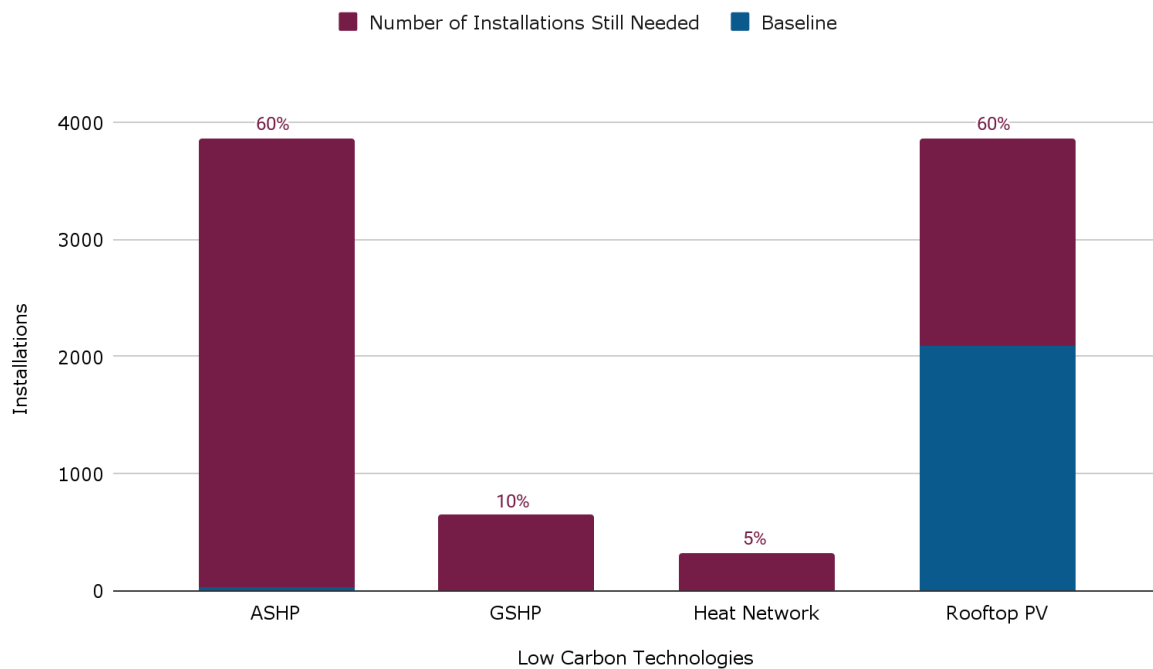


Figure 35: Non-Domestic Low Carbon Technology baseline (existing installations) compared against targets.

The financial implications further underline the difficulty of meeting the 2030 targets. Cost estimates were derived by applying the targets to the domestic and non-domestic building stock within the Winchester district to calculate the total number of installations required by 2030. From this figure, the existing baseline installations were subtracted to determine the number of additional installations still needed. The average cost per technology was then multiplied by the number of remaining installations to estimate the total investment requirement per technology.

Based on this methodology, the remaining domestic installations represent an estimated investment requirement of approximately £990 million. The largest components of this total are air source heat pumps (approximately £455 million) and rooftop PV (approximately £295 million), with ground source heat pumps and insulation measures comprising the remainder. For the non-domestic sector, an additional investment of approximately £157 million is required. Combined, this implies over £1.1 billion of investment within the next five years, excluding associated costs such as grid reinforcement, programme delivery, consumer engagement, and workforce development.

Table 3: Cost to meet High Ambition-2030 targets for each low carbon technology (non-domestic).

Technology (Non-Domestic)	No. of Installations Remaining	Total Cost £
Rooftop PV	1771	60,137,000
Air Source Heat Pump	3836	77,786,000
Ground Source Heat Pump	636	19,103,000

Table 4: Cost to meet High Ambition-2030 targets for each low carbon technology (domestic).

Technology (Domestic)	No. of Installations Remaining	Total Cost £
Rooftop PV	31756	295,133,000
Air Source Heat Pump	46082	454,686,000
Ground Source Heat Pump	5841	120,127,000
Insulation Cavity Wall	9155	10,737,000
Insulation External Wall	9926	77,437,000
Insulation Loft	3203	2,352,000
Insulation Underfloor	13832	25,535,000

Taken together, the analysis shows that Winchester's 2030 targets set a clear and ambitious direction of travel and crucially provide a strong platform for accelerated progress through the remainder of the decade. While achieving the full 2030 ambition would require a step-change in delivery compared to historic rates, the scale of deployment also highlights where action will have the greatest impact: scaling

mature insulation measures at pace, while rapidly expanding low-carbon heat and power solutions such as heat pumps and rooftop solar.

The modelling therefore points to a practical route to success: prioritising high-readiness measures early, strengthening delivery capacity and the local supply chain, and using interim milestones to track progress and adapt the programme over time. With coordinated investment, effective consumer engagement and proactive workforce planning, Winchester can secure substantial emissions reductions by 2030, reduce energy bills for residents and businesses, and build the foundations required for long-term delivery. Importantly, the 2030 targets are not the same as achieving net zero; rather, they act as a catalyst for immediate action, accelerating progress in the near term and ensuring that each year of delivery contributes meaningfully toward the district's longer-term 2050 net zero trajectory.

4.2 Large-Scale Generation

Modelling of large-scale generation potential identifies a practical pathway for renewable energy development in Winchester that works within the existing electricity network. This potential has been modelling agnostic of scenarios, given the exact sites and their development will be highly subject to developer choices and market processes. Over the next 25 years, it is possible to deploy 292 megawatts of clean energy across 1,012 carefully selected sites, generating 308 gigawatt-hours of electricity annually. As part of the site-selection process, areas with significant planning constraints - including the South Downs National Park and other protected designations - were excluded to ensure only realistically developable land was considered. This approach balances environmental goals with infrastructure realities, ensuring projects can connect to the grid without requiring immediate expensive upgrades. The deployment maximises use of existing grid capacity while maintaining reliable electricity supplies for the region.

The technology mix focuses primarily on ground-mount photovoltaic installations, which account for 94.5% of the planned capacity, with wind energy making up the remaining 5.5%. This solar-dominated approach reflects both the area's favourable solar resource and the proven reliability of PV technology. Most projects will connect at the local distribution level, keeping connection costs between £19–54 million. The deployment schedule spans from 2025 to 2050, with projects distributed evenly across the years to create a manageable development pipeline. Overall, the programme uses around half of the available local grid headroom - meaning the model allocates capacity only where suitable land and substation headroom align - ensuring steady progress without overwhelming the grid or local resources.

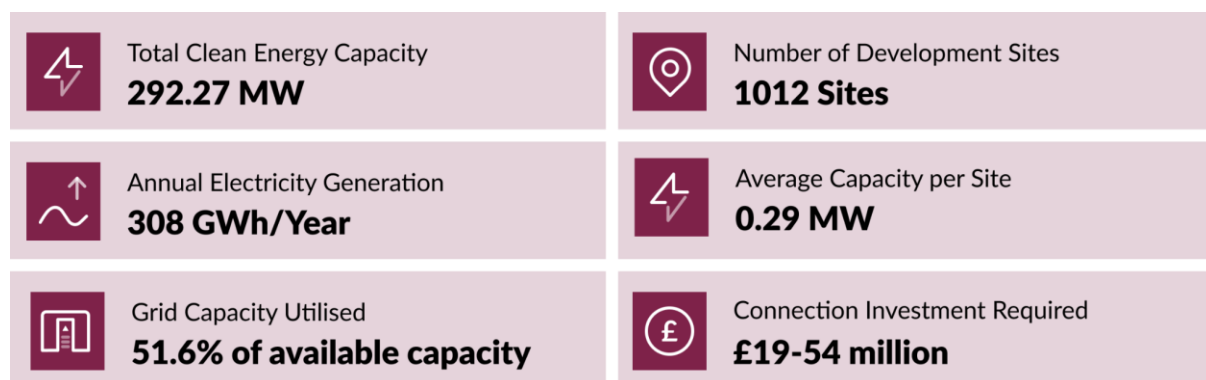


Figure 36: Summary of key metrics from the large-scale generation deployment outputs.

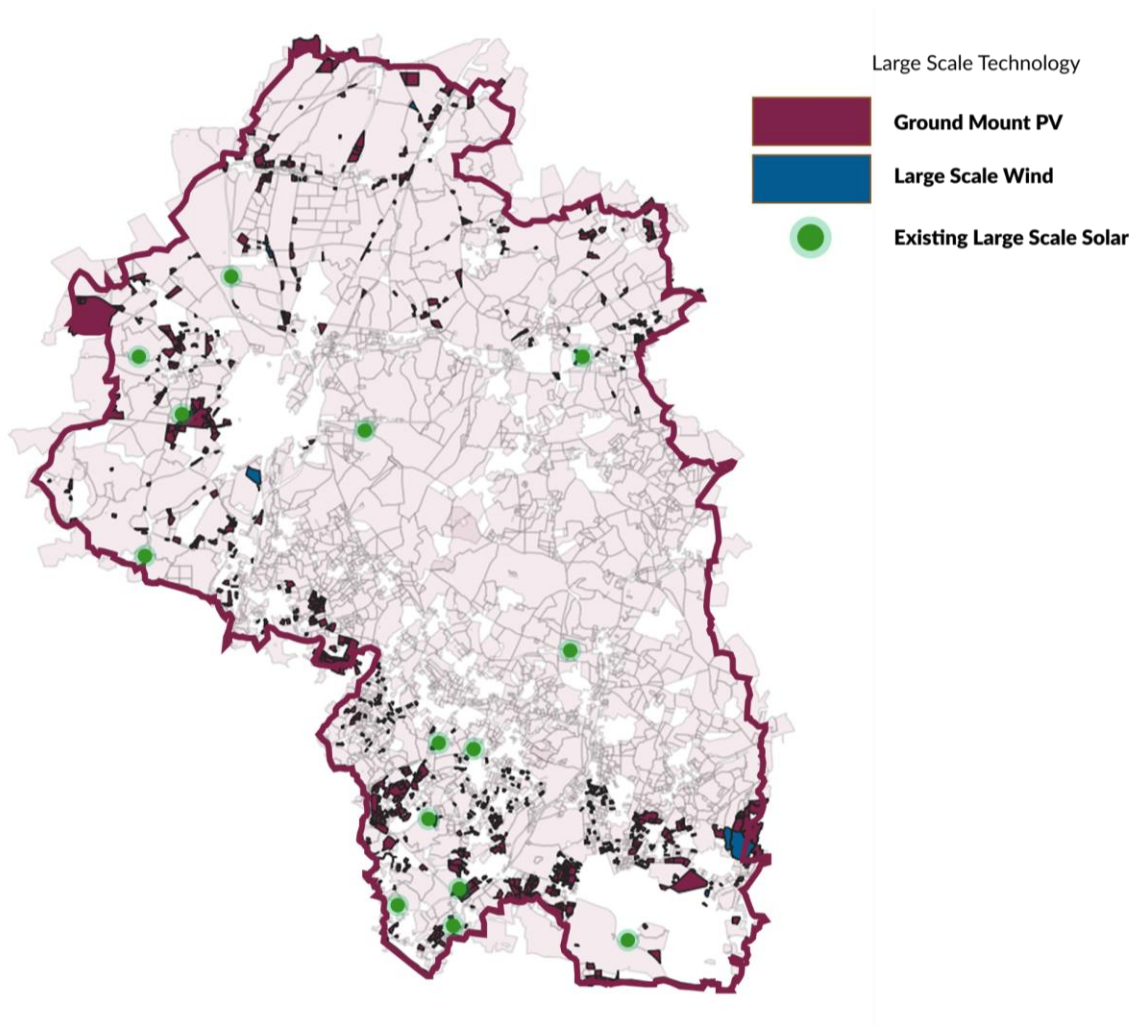


Figure 37: Parcels allocated to large-scale technologies by 2050. Dark purple represents ground-mounted PV, while blue denotes large-scale wind.

A key finding is that while the region has potential for over 12,000 megawatts of renewable energy, current grid infrastructure can only support 2.4% of this total. The remaining projects require targeted grid upgrades to unlock their potential. This creates a clear roadmap for infrastructure investment, where strategic upgrades at priority substations could unlock over 1,000 megawatts of additional capacity. The analysis identifies specific locations where upgrades would provide the greatest benefit, allowing for phased investment that aligns with deployment schedules and budget considerations.

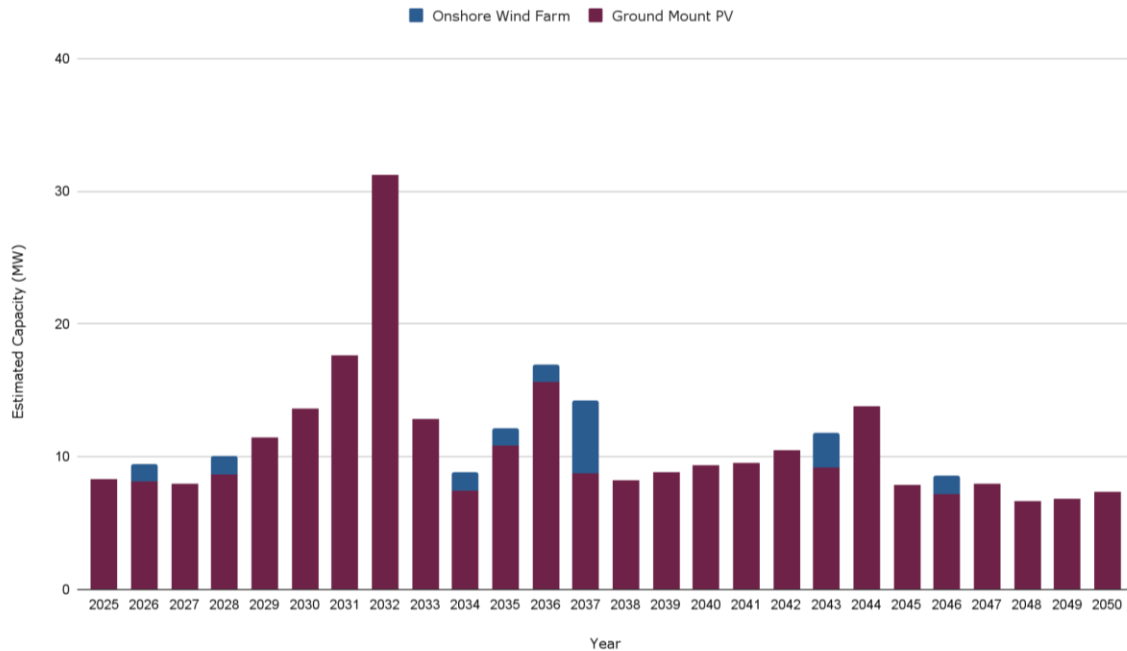


Figure 38: Estimated capacity (MW) deployment overtime by Large-Scale Technology

The spatial distribution of projects creates a resilient energy system across multiple substation areas, reducing reliance on single points of failure and creating local economic opportunities. Most projects are relatively small-scale, averaging under 0.3 megawatts per site, smaller than the average size of existing solar farms in the district (typically 3–40 MW) and therefore complements, rather than competes with, current large-scale generation. This scale is also well-suited to community energy groups and aligns with the ambitions of the Local Power Plan to expand locally owned generation. This distributed approach enhances grid stability while providing a clear foundation for Winchester's net-zero objectives. The next steps involve detailed planning for priority grid upgrades and coordination with network operators to ensure the region can progressively unlock its full renewable energy potential.

4.2.1 Large-Scale Storage

As large-scale renewable generation increases across Winchester, battery storage will play an important role in supporting system flexibility, reducing curtailment, and maximising the use of available grid capacity. Modelling undertaken for this LAEP indicates a steady rise in co-located storage deployment alongside new large-scale solar PV and wind developments.

Cumulative large-scale generation capacity reaches around 280 MW by 2050, with co-located battery storage increasing to around 1,120 MWh over the same period (Figure 39). Storage deployment accelerates during the early 2030s as new renewable sites come online, before increasing more gradually through to 2050. The four-hour duration storage systems assumed in the modelling provide short-duration flexibility, enabling surplus daytime solar generation to be shifted into higher-demand evening periods.

The projected storage rollout reflects current UK market practice, where developers increasingly co-locate batteries with generation to optimise grid connections and reduce curtailment risk. However, the timing of deployment will depend on continued investor confidence, the evolution of flexibility markets, and the availability of viable grid connection points. Close collaboration between the local authority, the

DNO, and renewable developers will be important to ensure that storage is delivered in locations that provide the greatest system benefit.

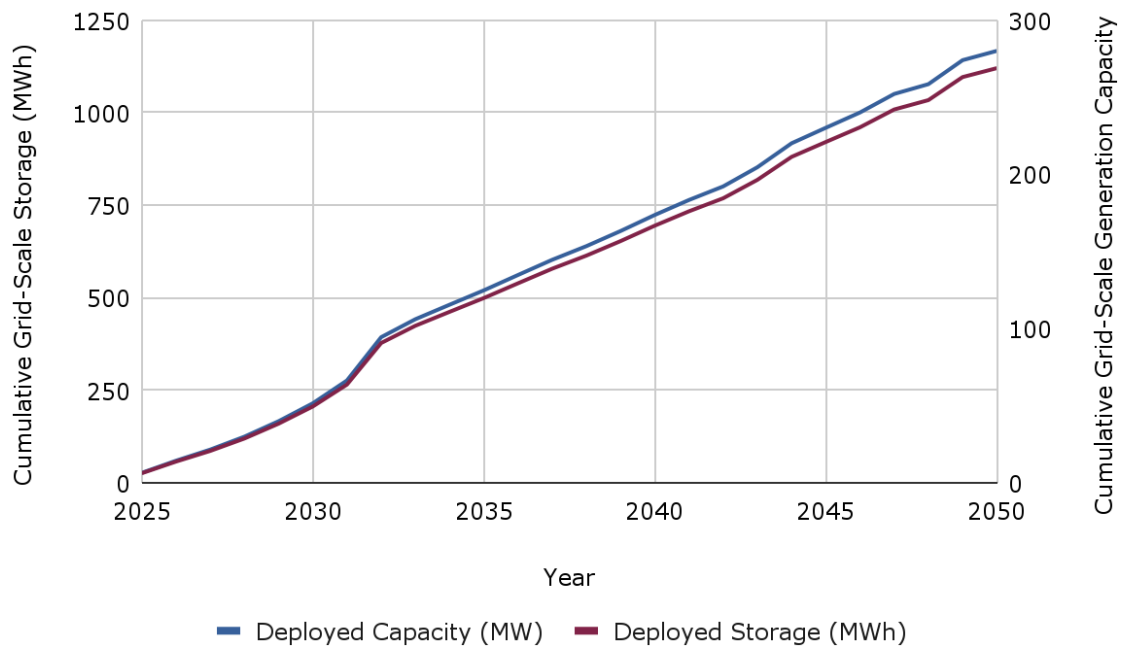


Figure 39: Cumulative large-scale renewable generation capacity (MW) and co-located battery storage (MWh) deployed in Winchester between 2025 and 2050.

4.3 Transport

Transport represents a significant share of Winchester's emissions, and although wider decarbonisation opportunities exist - such as modal shift, active travel, public transport improvements and fleet transition - this LAEP concentrates on the infrastructure required to support electric vehicles. EV charging has been modelled separately from the main scenario tool used for buildings, as it relies on different datasets, behavioural assumptions and national ZEV-mandated uptake trajectories. For this reason, EVCP deployment is presented as a single pathway rather than across multiple ambition levels, offering a clear and consistent view of the charging infrastructure needed to enable the district's transition to zero-emission mobility.

4.3.1 Public EV Charging

At present, Winchester has approximately 216 public EV chargepoints (EVCPs). To meet future demand, modelling undertaken for this LAEP indicates that the number of public EVCPs will need to scale by an order of magnitude, reaching around 2,200 public chargers by 2050. This will supply power to fleets, visitors and residents without access to off street charging infrastructure - especially for households without access to off street parking (16,655 properties).

This aligns with the national trend where public charging gradually becomes a critical supplement to near-home and workplace charging, especially for residents without off-street parking, visitors, and longer-distance travellers.

The chart below illustrates the projected total public EVCP requirement for Winchester to 2050, the trajectory reflects strong early growth to support accelerating EV uptake in the 2030s, before stabilising in the 2040s once the majority of vehicles have transitioned.

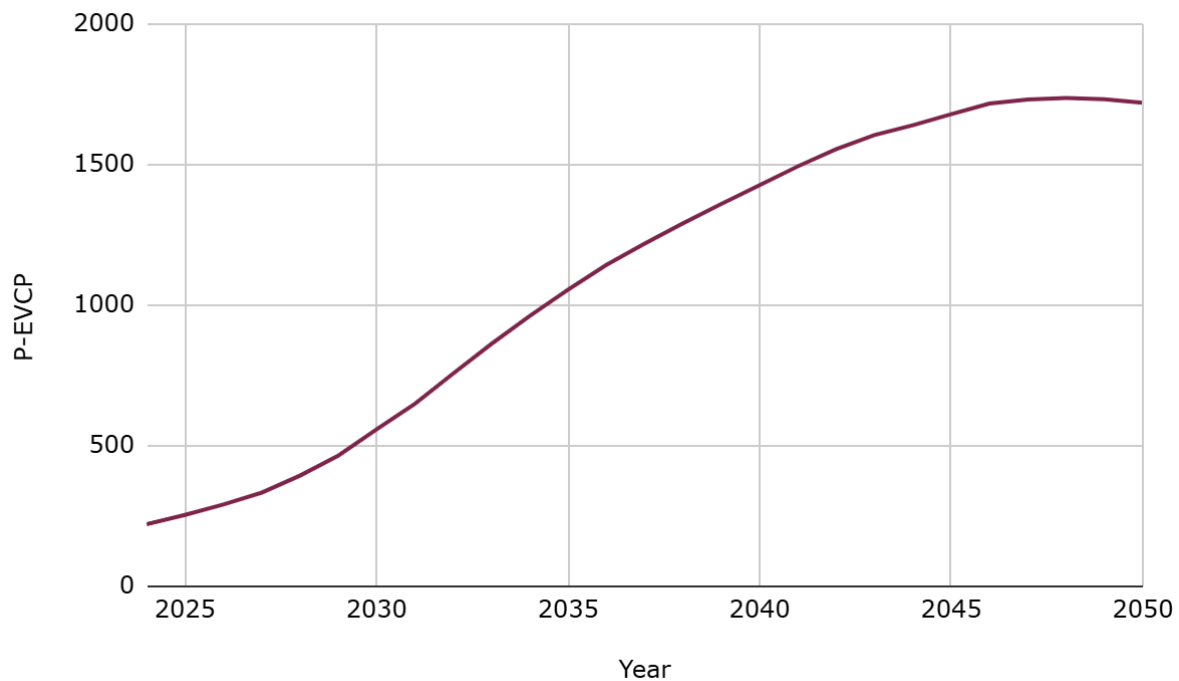


Figure 40: Projected number of Public EVCP for Winchester by 2050.

Public EV charging in Winchester is expected to comprise a blend of standard and rapid/ultra-rapid DC chargers, reflecting the differing needs of residents, commuters, and visitors. For this LAEP, EV charging projections are derived from CENEX's National EV Insight & Support (NEVIS) and assume that EV uptake follows Zero Emissions Vehicle (ZEV) mandated targets each year with no borrowing. The combined strategy ensures that the charging network is balanced, resilient, and inclusive, supporting both routine daily travel and regional mobility. By 2050, the distribution is expected to stabilise, with standard chargers making up the largest share of sockets, complemented by a growing proportion of rapid and ultra-rapid chargers to support higher throughput locations.



Figure 41: The projected number of charging sockets across the main power categories by 2050.

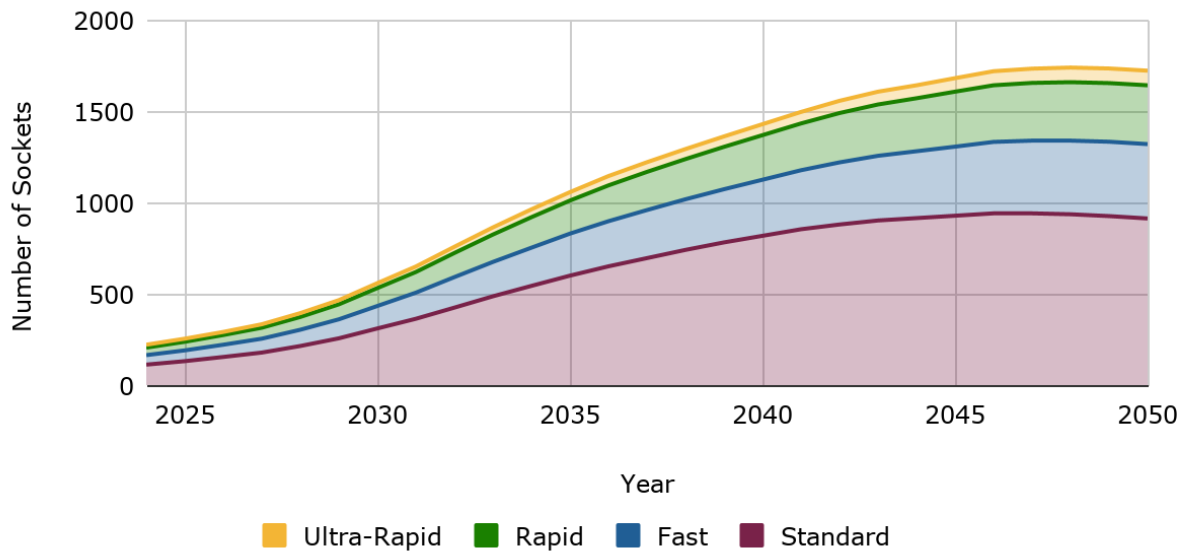


Figure 42: Projected Public-EVCP distribution by power rating.

By 2050, Winchester will require a robust, future-proofed EV charging network to support expected ZEV charging needs. Key features of this transition include:

- Growth from 4,774 EVs today to around 78,000 EVs by 2050
- Expansion of 221 public chargers today to approximately 2,200 by 2050
- A balanced mix of standard, fast, rapid, and ultra-rapid chargers
- A combined residential and hub-based strategy, ensuring equitable access

This planned infrastructure will help ensure that Winchester's residents, visitors, and businesses can confidently transition to zero-emission transport.

4.3.2 Private EV Charging

The analysis shows that off-street charging installation on all properties with driveway space is likely to be achieved by 2035. Starting from a baseline of 4,344 existing private chargepoints, the LAEP projects installations across a further 30,116 suitable properties in Winchester that have space to park and charge at home. Alongside some on street charging infrastructure - necessary for areas without off street parking - these figures represent full coverage of the identified need. The deployment program spans a ten-year period from 2025 to 2035, with installation activity building gradually in the early years before reaching peak levels in the middle period and concluding naturally as all suitable properties are served. This will need to be supplemented by some on street domestic chargers, especially in areas where residents have no access to off street parking.

The deployment timeline reflects a measured approach that balances rapid progress with practical installation constraints. The modelling scales up steadily, reaching peak deployment of 4,974 installations in 2034. This progression allows installation teams to build capacity and expertise while maintaining quality standards. The final year sees only 80 remaining installations, indicating successful completion of the comprehensive deployment program. The chart below illustrates this cumulative growth, showing how new installations accumulate from zero to reach full coverage of all suitable properties by 2035.

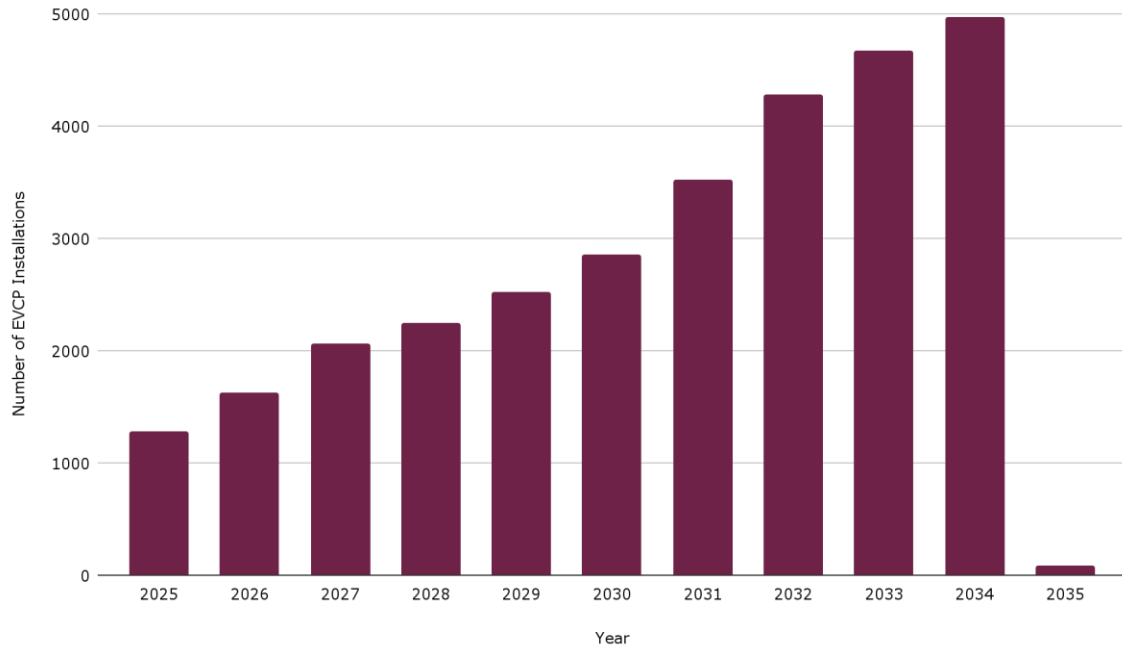


Figure 43: Number of Private-EVCP Installations per Year.

Table 5: Number of Private EVCP Installations and their annual investments.

Year	New Installations	Cumulative New Installations	Annual Investment (£M)
2025	1,278	1,278	1.21
2026	1,620	2,898	1.53
2027	2,058	4,956	1.94
2028	2,251	7,207	2.13
2029	2,523	9,730	2.38
2030	2,859	12,589	2.70
2031	3,519	16,108	3.33
2032	4,279	20,387	4.04
2033	4,675	25,062	4.42
2034	4,974	30,036	4.70
2035	80	30,116	0.08

The table above summarises annual deployment. Annual installation represents a practical installation capacity, taking into account behaviour change and the transition times necessary to commission and install a charger. The cost and decision to adopt domestic ZEV infrastructure is largely driven by consumer choice, but can be influenced by local policy and guidance on options, such as non-standard installations such as the growing use of gullies to support on street charging with a private off-street charger. Hampshire County Council currently does not permit cable gullies or cross-pavement channels, which limits their rollout, though this position may change as new products are approved and as forthcoming local government reorganisation creates new unitary authorities that may take a different view.

| 5 Implementation

This section translates the scenario modelling and future energy system analysis into some key implementation areas for Winchester's Local Area Energy Plan (LAEP). It identifies priority intervention themes, as well as a selection of near-term actions and longer-term measures. The focus is on low-regret and quick-win interventions, with some consideration for scaling more complex infrastructure over time.

5.1 Intervention Themes

Energy efficiency is a core pillar common to all scenarios. Improving building fabric reduces overall energy demand, which in turn lowers the scale and cost of other interventions. By cutting heat demand, energy efficiency makes low-carbon heating easier to deploy, reduces pressure on electricity networks, and delivers immediate benefits for residents through lower bills and more comfortable homes.

Heat decarbonisation represents the largest structural change to Winchester's energy system. The modelling shows that electrification through heat pumps is central to most pathways, complemented by district heat networks in locations where density and heat demand support them. The LAEP therefore supports a phased and area-based approach to heat, while maintaining flexibility to respond to future national policy decisions.

Transport decarbonisation is driven primarily by the transition to electric vehicles, supported by expanded charging infrastructure and complementary measures to reduce car dependency. Provision of charging infrastructure is critical to incentivise and enable adoption, particularly for residents without access to off-street parking.

Renewable electricity generation and storage, both on rooftops and at large scale, are key to the generation of *local* low carbon electricity. Rooftop solar provides a highly deliverable, low-cost source of local electricity, while larger solar PV farms and wind generation play a growing role in meeting district-wide demand. Battery storage enhances system flexibility, helping to manage peak loads and integrate higher levels of electrification.

Finally, all intervention themes rely on a shared set of **cross-cutting enablers**. Skills, finance, governance, policy alignment, and community engagement are critical to translating technical potential into real-world delivery. These enablers shape the speed, cost, and fairness of the transition and must be addressed in parallel with physical infrastructure deployment.

5.2 Priority Interventions Areas

5.2.1 Quick Wins

A key objective of the Winchester district LAEP is to identify opportunities for action and investment that can be delivered in the near term, particularly low-regret and quick-win interventions that are robust across scenarios. The following general measures are beneficial under all scenarios and can be implemented directly by Winchester City Council within the current governance arrangements. These actions reduce emissions immediately, lower energy costs, and build momentum for wider system change.

> 1. Insulation and fabric improvements across council owned assets.

This will support the council's ambition to reach carbon neutrality of council estates and reduce energy bills in the long term. Currently 102 non-domestic council properties are EPC D or below. All have potential to be EPC C or above, with the overwhelming majority listed as having potential for a B rating.

> 2. Non-domestic rooftop PV installations on council-owned and large commercial buildings.

This will also support the decarbonisation of council owned estates, especially if paired with storage. There are 59MW of rooftop PV capacity across all council owned non-domestic building stock in Winchester. Installing a proportion of this would represent strong potential to decarbonise Winchester's own estates and potentially sell exported power, whilst promoting the technology.

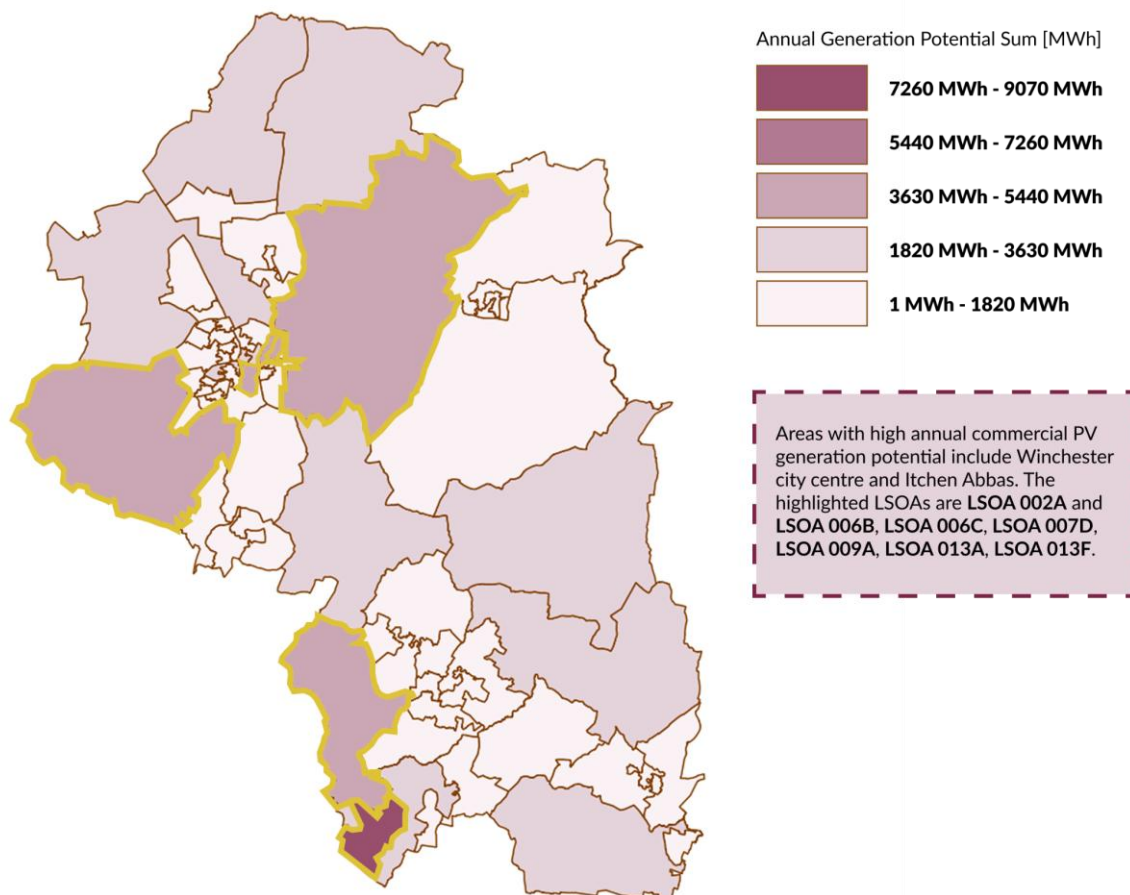


Figure 44: Distribution of all commercial PV annual generation potential by Lower Layer Super Output Area (LSOA).

The heatmap above highlights areas with the greatest annual generation potential from commercial Rooftop PV. Darker shades indicate LSOAs where suitable properties offer the highest combined generation potential.



Figure 45: LSOA 013F and its full building stock (domestic and commercial), with commercial properties suitable for PV shown in yellow.

Winchester shows substantial untapped potential for commercial PV, with several LSOAs standing out as priority intervention focus zones. Seven LSOAs demonstrate particularly dense clusters of high-potential commercial roofs. Among these, LSOA 013F (Figure 45) stands out as the highest-potential area in the district, with an estimated 9,070 MWh of annual generation potential. This is distributed across approximately 140 large commercial roof spaces, representing a combined roof area of around 70,000 m². Given its scale and concentration of suitable buildings, LSOA 013F represents the strongest candidate for early-stage project development and targeted engagement. While this assessment identifies strong technical potential, any future deployment would still require consideration of local grid constraints before progressing to delivery. These priority zones provide a clear foundation for identifying commercial clusters where coordinated PV deployment could deliver meaningful carbon and energy impacts.

> **3. Increasing public EV charging infrastructure in line with the NEVIS recommendations laid out in section 4.3.** This will support the residential and commercial transition to hybrid and zero emission vehicles. Winchester already has >200 public charging stations, of which >80 are 50kW or above. Areas such as Berewood, Old Park Farm and Winchester Avenue for example currently have no or few public chargers listed on Zap Map but a reasonable proportion of residents without access to off street parking. This suggests that prioritising investigating deployment of standard and fast chargers in domestic areas without access to off street parking is necessary to align with the NEVIS breakdown by charger type. This can be supported by government schemes such as LEVI; Hampshire County Council has secured over £6.6 million to expand on-street charging for residents without driveways.

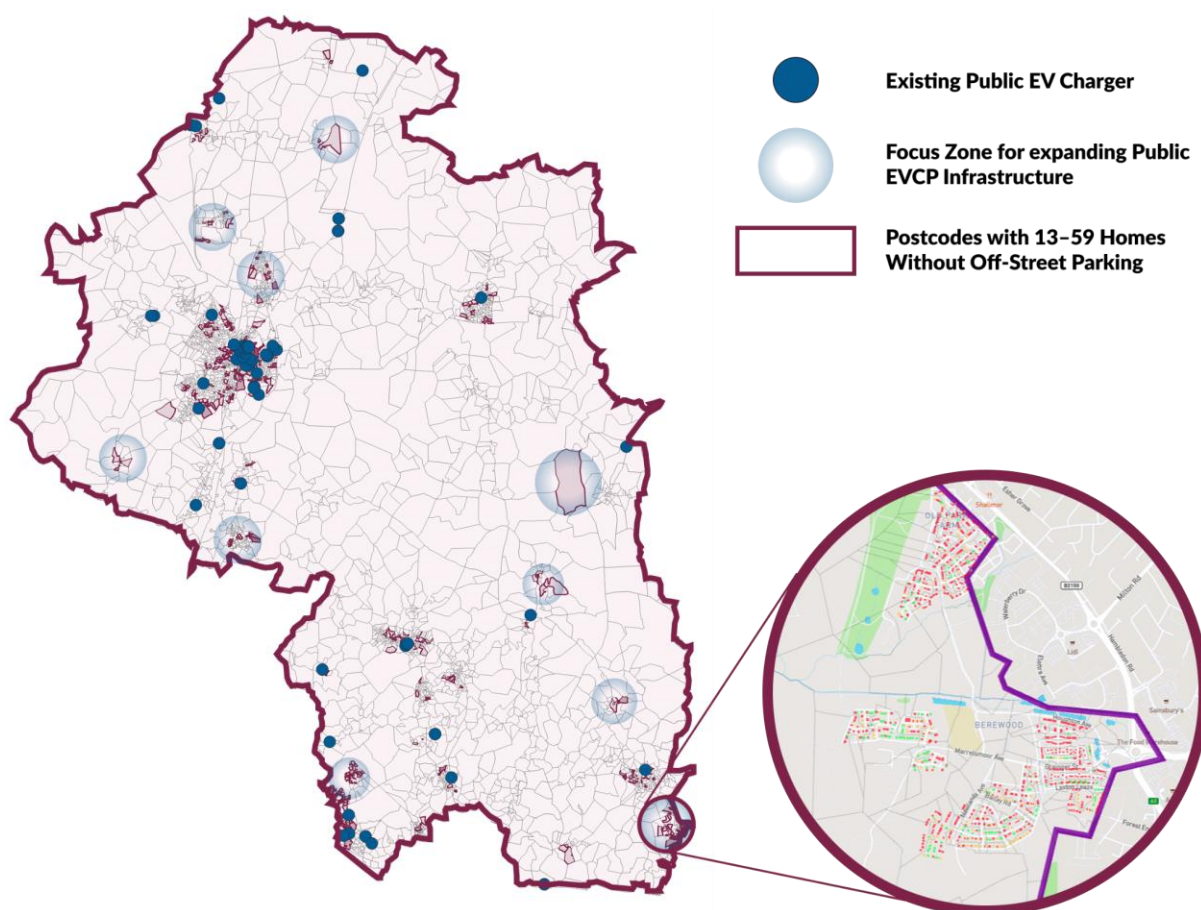


Figure 46: Postcodes with limited Off-Street Parking and priority focus zones (close up of Berewood Area).

Off-street parking suitability is assessed by examining the space available between each property and the nearest road, allowing identification of existing driveways. The assessment applies simple spatial thresholds, assuming approximately 15 m² is required for a single parking space and 30 m² for two. Although emerging solutions such as pavement gulleyways may enable some households to charge from home without a formal driveway, areas with limited off-street parking will continue to have a greater reliance on public or on-street charging. Highlighting where these properties are concentrated alongside analysis of existing public EVCP infrastructure helps indicate neighbourhoods where additional EV charging provision would deliver the greatest benefit.

The map above (Figure 46) identifies areas where the concentration of households without private parking is notably higher than the district average, including areas such as Berewood, Old Park Farm and Winchester Avenue. Focus zones have been highlighted where public charging coverage remains comparatively limited; without targeted intervention, residents in these areas may face greater barriers to EV adoption, slowing progress toward local and national decarbonisation targets. Prioritising action in these zones would support more equitable access to charging and help reduce pressure on on-street parking. Winchester can also work with county partners and regional bodies to secure appropriate shares of LEVI funding to accelerate delivery in these priority locations.

> 4. Promoting opportunities for businesses, schools, and residents to take up technologies.

For example, through promotion of funding schemes, identification of recommended suppliers, stakeholder engagement and collaborative projects where possible. There are 24 school buildings in Winchester which do not yet have rooftop solar PV but have suitable rooftops. Schools are a strong

focus area because they typically have large, unobstructed roof spaces, predictable daytime energy demand, and public visibility, making them well-suited for impactful, community-supported installations.

Figure 47 illustrates the locations of remaining potential for PV installations on schools in Winchester. Installing PV on these schools at the recommended system sizes would add around 1.8 MW of capacity to Winchester's network while saving an estimated 746,906 kg of carbon over the next five years and up to 1,244,266 kg by 2040. The required investment is approximately £1.87 million, covering labour and material costs. This scale of potential generation highlights the value of schools as priority sites, but it also brings the local network into focus. The St Cross and Alresford primary substation supply areas contain the highest number of schools suitable for PV, with five in each. Both are red for headroom RAG status, indicating that the local network is already operating close to its capacity. In these zones, additional PV may require early engagement with the DNO to understand feasible connection pathways.

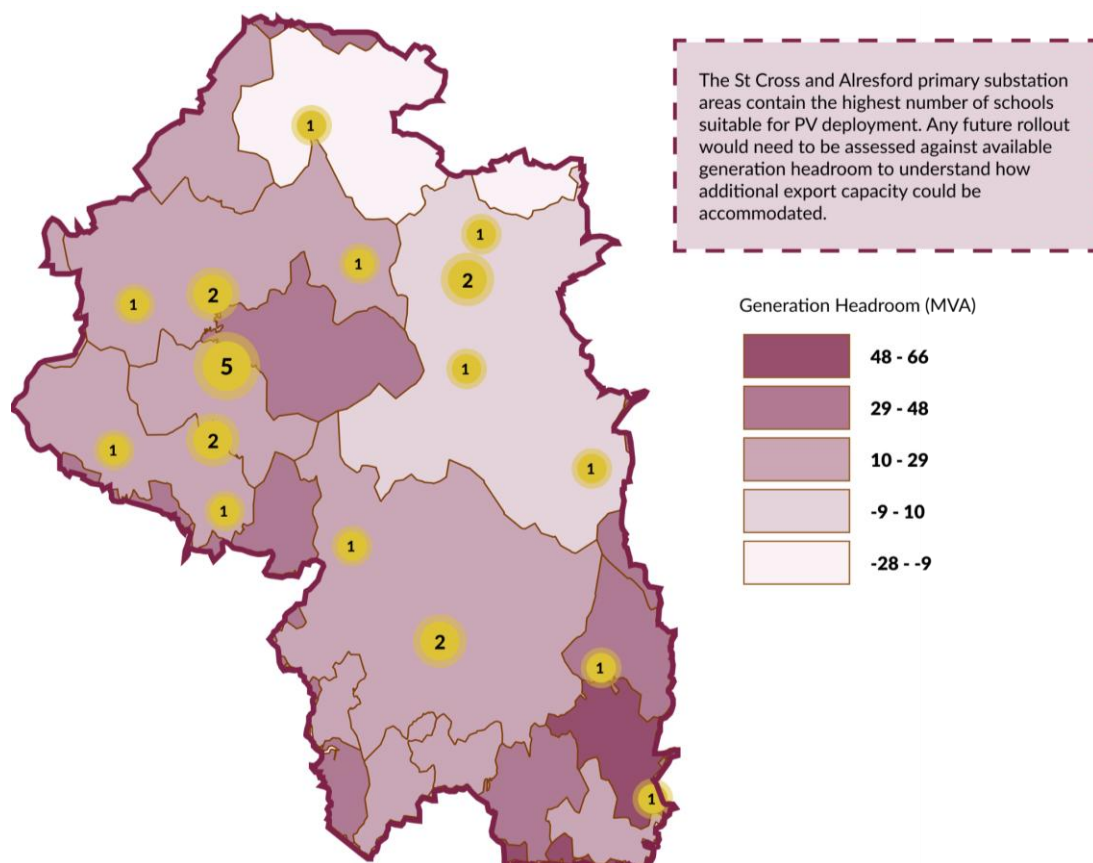


Figure 47: Locations of remaining rooftop PV installation on schools and their corresponding supply areas.

Year	Carbon Saving (kg CO2)
1	194,706
5	746,906
10	1,088,283
15	1,244,266

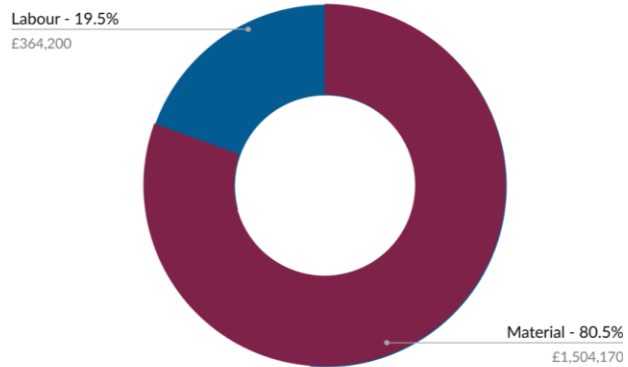


Figure 48: Summary of cost and carbon impacts for Rooftop PV deployment on all remaining schools.

> 5. Work with network operators early.

To establish which areas of the network are likely to face constraints and develop remediation plans, such as reinforcement, flexibility or amended deployment plans.

5.2.2 Later pipeline improvements

From 2028 onwards, the new unitary council can scale more complex interventions:

1. Exploration of heat network opportunities in more urban areas, beginning with zones identified as having high heat demand and strong anchor loads.
2. Expansion of heat pumps in council owned building stock and households who qualify for government funding schemes, supported by continued fabric retrofit.
3. Continued expansion of EV infrastructure and renewable generation, including consideration of larger scale generation opportunities alongside rooftop PV.

Policy-Dependent Choices: Some pathways depend on national policy decisions and infrastructure investment. In particular, hydrogen for heating and large-scale hydrogen deployment remain uncertain and should be treated as contingent options rather than core delivery assumptions.

5.2.3 Long Term Measures 2030-2050

As electrification deepens, longer-term measures become increasingly important which will require collaboration across communities, businesses, local and national government and network operators:

1. Energy network reinforcement and upgrades to accommodate rising demand from heat and transport.
2. Large-scale renewable generation and storage, enabled by strategic grid upgrades.
3. Smart local energy systems, including flexibility, storage, and demand-side response to manage peak loads.

5.3 Action Plan and Next Steps

The LAEP provides an evidence base rather than a fixed delivery programme. Implementation therefore requires an iterative action plan that evolves alongside policy, funding, and market conditions.

Key next steps include:

1. **Translate priority interventions into a delivery programme**, identifying lead organisations, funding sources, and indicative timelines.
2. **Embed LAEP priorities into local policy**, including planning, asset management, housing strategies, and transport plans.
3. **Develop area-based pilot projects**, particularly for heat networks, retrofit programmes, and EV charging, to test delivery models and build local confidence.
4. **Strengthen partnerships** with network operators, developers, housing providers, and community energy groups.
5. **Monitor and review progress**, using updated data and future iterations of the LAEP to refine targets and actions every 5 years.

5.4 Wider Benefits

Delivering the priority interventions identified in the LAEP will generate significant wider benefits beyond carbon reduction.

Economic Benefits:

1. Creation of local jobs in insulation, heat pump installation, PV deployment, EV charging, and system maintenance.
2. Development of local supply chains and skills, supporting long-term economic resilience.

Social Benefits:

1. Reduced energy bills through improved efficiency and local renewable generation.
2. Lower fuel poverty and improved thermal comfort in homes.
3. Health benefits from warmer homes, cleaner air, and increased active travel.

Environmental Benefits:

1. Significant reductions in greenhouse gas emissions from buildings and transport.
2. Improved local air quality through reduced combustion of fossil fuels.
3. Increased resilience through diversified, locally generated energy supply.

Policy Alignment:

The LAEP supports delivery of local, regional, and national objectives, including:

1. The UK Net Zero Strategy and carbon budgets.
2. Transition to zero-emission vehicles and improved active travel.
3. Long-term decarbonisation of heat and power systems.

By focusing on low-regret actions now while keeping options open for future technologies, Winchester can deliver a just, resilient, and affordable energy transition that benefits residents, businesses, and the wider region.

6 Scenarios Compared

6.1 Cost Compared

The table below summarises the total domestic and non-domestic CAPEX costs for each scenario and compares this to relative CAPEX costs in the Business-as-Usual counterfactual scenario. Medium ambition is seen here as the most cost-effective option.

*Table 6: Total Technology CAPEX costs by Scenario**

Scenario	Total Cost (Combined)	Cost vs Business as Usual	Highest Expense
High Ambition	£925.7m	+£93.9m	Heat network, rooftop PV
Medium Ambition	£1.61bn	+£781.5m	ASHP, heat networks, rooftop PV
Low Ambition	£1.86bn	+£1.03bn	ASHP, heat networks, rooftop PV
High Hydrogen	£2.17bn	+£1.34bn	Hydrogen boilers, ASHP, heat network, rooftop PV
Business as Usual	£831.8m	—	ASHP, rooftop PV

* Costs for new build developments, network reinforcement or decommissioning are not included in this table.

Across all active scenarios, four technologies dominate the cost profile:

1. Rooftop PV remains a major contributor to total CAPEX, with deployment costs ranging from approximately £351.5 m under High Ambition to £847.9 m in the High Hydrogen scenario.
2. Air Source Heat Pumps (ASHPs) are the primary driver of cost variation, increasing sharply with ambition - from £131.4 m in High Ambition to £489.9 m under Low Ambition and £263.6 m in the High Hydrogen pathway.
3. Heat networks represent a consistent infrastructure investment of £347.7 m across most scenarios, particularly significant for non-domestic applications.
4. Insulation measures remain relatively modest in cost (combined under £73 m even at large-scale rollout) but enhance energy efficiency and overall system performance.

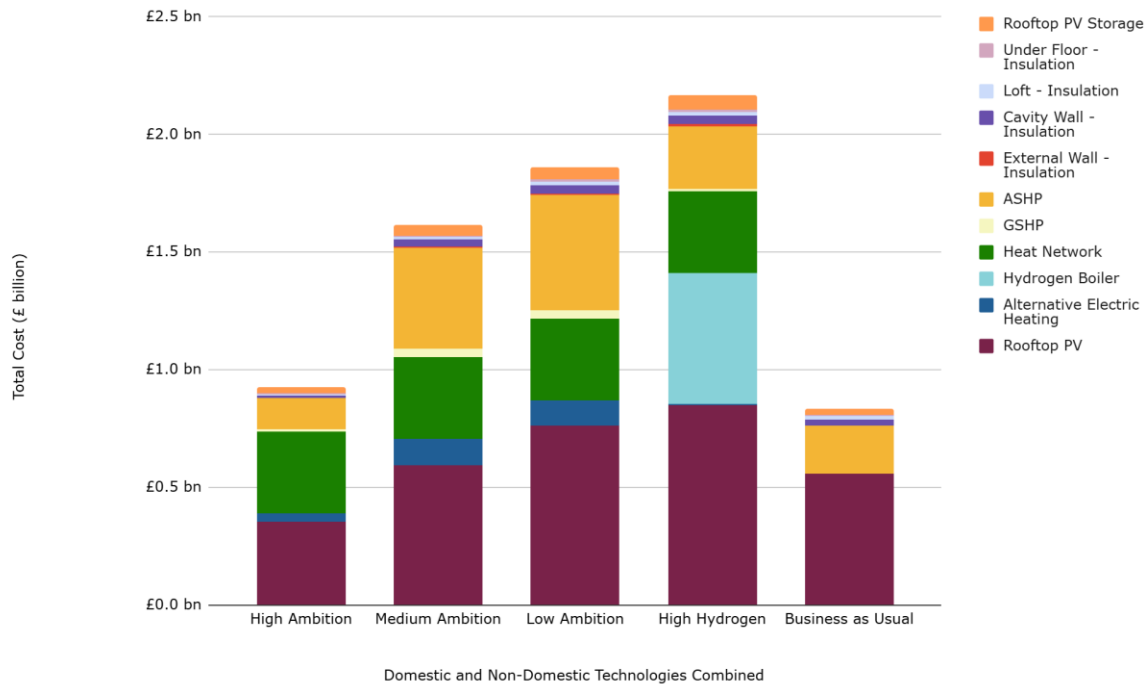


Figure 49: Distribution of total CAPEX costs across the scenarios, segmented by Low Carbon Technology.

6.1.1 Funding Responsibility

Financial responsibility for the energy transition is distributed across networks, residents, businesses, local government, central government, and private investors. Different technologies carry very different funding landscapes and understanding these is essential for key decision makers when considering priority intervention areas. A range of national schemes also shape how costs fall across different groups—for example, payments for exported electricity through the Smart Export Guarantee, long-term price stabilisation for larger generators via Contracts for Difference, and support for low-income households through ECO4 Flex, which applies only to private homes rather than public buildings. These sit within a much wider and evolving funding environment, so the examples included here are illustrative rather than exhaustive. The table below provides an indication of how funding responsibility can vary.

Table 7: Funding Responsibility Across Technologies.

Technology	Residents	Businesses	Council	Central Govt / Energy Networks
Rooftop PV (Domestic)	Primary funder (self-fund or loan)	—	Energy company Obligation (ECO4) Flex gateway; public estate	Energy Company Obligation (ECO4), Warm Homes Local Grant (low income); Smart Export Guarantee (SEG)

Rooftop PV (Non-Domestic)	—	Primary funder (AIA, PPAs, loans)	Public estate buildings; facilitation	Schools via Great British Energy; SEG, Contracts for Difference (CfDs)
ASHP / GSHP (Domestic)	Co-fund; Boiler Upgrade Scheme (BUS) grant support	—	Warm Homes Local Grant delivery	Boiler Upgrade Scheme (BUS), Energy Company Obligation (ECO4), Warm Homes Plan
Heat Networks	Heat tariffs (consumers)	Corporate consumers	Lead / co-develop; anchor demand	Green Heat Network Fund ; private developers, DNOs
Insulation (Domestic)	Self-fund (above fuel poverty threshold)	—	LA Flex eligibility gateway	Energy Company Obligation (ECO4), Great British Insulation Scheme
Hydrogen*	Potential change to bills	Industrial users	Advocacy / planning only	Gas network / National Gas operators
Public EV Chargers	—	—	Lead / create on-street strategy	Local Electric Vehicle Infrastructure (LEVI) Fund; Office for Zero Emission Vehicles (OZEV) grants; DNO network investment
Private EV Chargers	Primary funder (self-install or loan)	Workplace charging (self-fund / OZEV)	Policy guidance; planning conditions	Office for Zero Emission Vehicles (OZEV) workplace / residential grants
Large Scale Generation	—	Primary developer / investor	Planning authority; land strategy	Contracts for Difference (CfDs); grid connection investment (DNO)

*Only available in the High Hydrogen Scenario

6.1.2 A Note on Interpreting Costs

The scenarios assessed in this LAEP differ in both the technologies assumed and the delivery timeframes modelled: High Ambition runs from 2025–2030, Medium Ambition from 2025–2040, and Low Ambition, High Hydrogen, and Business as Usual to 2050. Differing horizons should be considered when interpreting costs: a higher total cost does not necessarily mean a less efficient pathway, and shorter timeframes imply much higher annual investment and installation rates.

Operational costs (not shown) should also be considered as these affect consumer and business bills. More efficient technologies and improved energy efficiency will reduce consumer bills over the long-term creating an overall cost benefit, despite high upfront CAPEX costs. This long-term benefit is modelled for every property in each scenario to identify a cost-optimised pathway.

6.1.3 Financial Support and Council Support

Barriers to adoption can be reduced through funding support mechanisms and engagement. Funding like the Boiler Upgrade Scheme (which provides a £7,500 grant towards heat pumps), ECO4, Warm Homes Local Grant and other mechanisms are available and similar future incentives are likely. Winchester City Council can boost uptake as a delivery partner for national schemes, facilitate access to finance, and where resources allow, provide complementary local support for households in hard-to-retrofit properties. Some of these mechanisms, such as [ECO4](#) and the [Warm Homes: Local Grant](#), target those in fuel poverty or on low incomes. For households above those thresholds, financial support can sometimes still be accessed via mechanisms such as the [Boiler Upgrade Scheme](#), [OZEV grants](#) and green finance products.

For businesses and non-domestic properties, the expectation is largely self-funded investment, supported by tax incentives such as the Annual Investment Allowance and financing structures such as Power Purchase Agreements for solar PV. Workplace EV charging follows the same principle but with some businesses funding available through OZEV's workplace charging scheme. The council's role is primarily facilitation - promoting available routes, aggregating demand, and ensuring its own estate leads by example.

6.2 Change in Energy Demand

6.2.1 Energy Demand across Scenarios

The shift away from fossil fuels and improvements in energy efficiency will lead to substantial changes in the energy system. All scenarios start from the baseline published by the Department for Energy Security and Net Zero (DESNZ) in the [Sub-national residual fuel consumption in the United Kingdom \(2023\)](#).

Table 8: Baseline energy demand*

DESNZ Fuel type	Domestic (GWh)	Non-domestic (GWh)	Total (GWh)
Electricity	223	332	556
Gas	533	190	724
Petrol cars total	-	-	538
Diesel cars total	-	-	451
Electric vehicles total	-	-	40
Other transport	-	-	668
Other	130	138	268
Total	887	661	3,245

*Excludes rail and agriculture

Changes in demand from the common baseline, are presented below across all scenarios for industrial, domestic and non-domestic demand (Rail and agriculture are excluded from this assessment). All the scenarios represent a reduction in net fuel demand; however, their reduction rate is variable and depends on the technology adoption rate in each scenario. All scenarios also take account of heat demand

increase from new builds - projected to increase demand by 0.9-1.1GWh each year. These new builds are assumed to be significantly more efficient than older housing stock as they will need to comply with the Future Homes Standard.

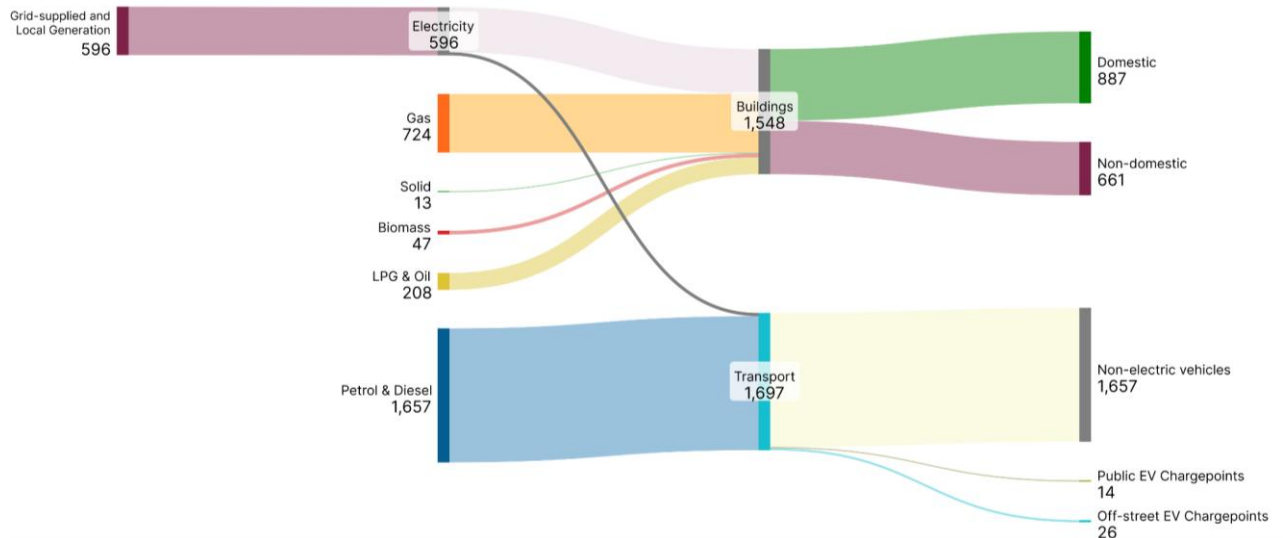


Figure 50: Characterisation of fuel demand in baseline year (in GWh).

Electricity demand increases across all scenarios due to electrification in transport and heating. Least growth in electricity demand is seen in High Hydrogen as heating shifts primarily from gas to hydrogen and most growth is in Medium Ambition as less efficient alternative electric heating technologies are more prominent than the slower Low Ambition scenario. Business as Usual sees the lowest reduction in overall demand as it assumes no rapid change from current technology uptake rates and no changes beyond already committed policies (e.g. Future Homes Standard).

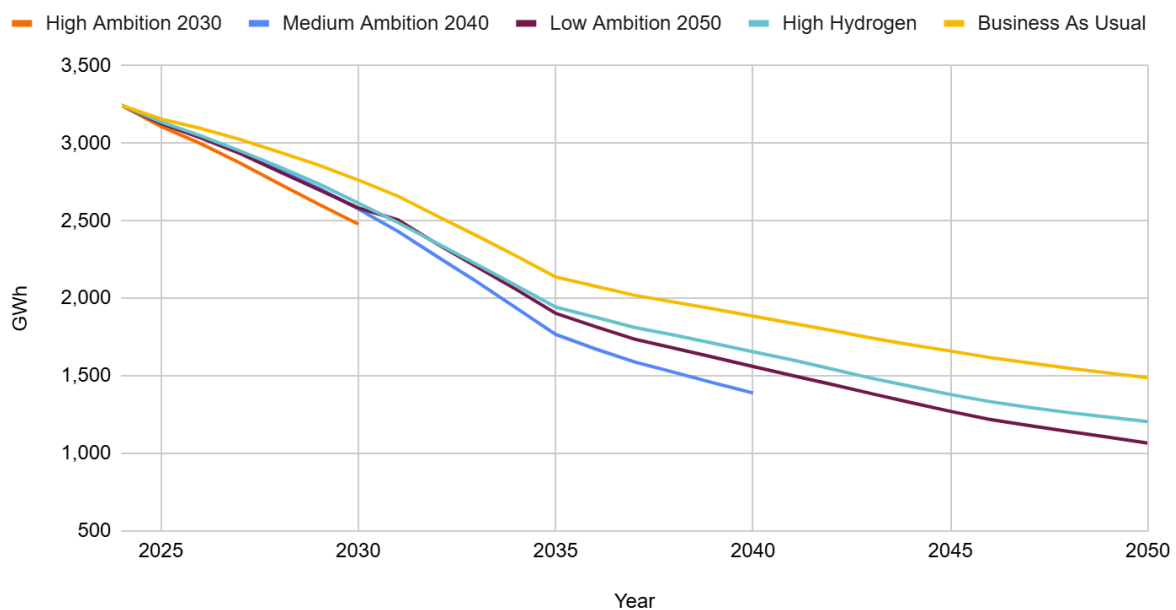


Figure 51: Fuel demand change compared across each scenario pathway.

6.2.2 Breakdown of Energy Demand in the Medium Ambition (2025-2040) Scenario

The below analysis compares the current energy system in Winchester with a possible future state by 2040 under the Medium Ambition scenario. Notably, this scenario does not eliminate all fossil fuels, and some may remain by 2040. This includes minimal residual use of fossil fuels in non-domestic processes and more substantial demand in transport. The ban on sales of new petrol and diesel cars from 2030 and on hybrid vehicles from 2035 results in substantial fuel demand shifts. However, this likely will not wholly eliminate petrol and diesel demand by 2040, as older vehicles remain on the road. This poses a significant challenge to Net Zero ambitions. Encouraging transport shifts will mitigate this, but offsets would likely be required to achieve full mitigation of all greenhouse gas emissions - such as carbon capture and sequestration.

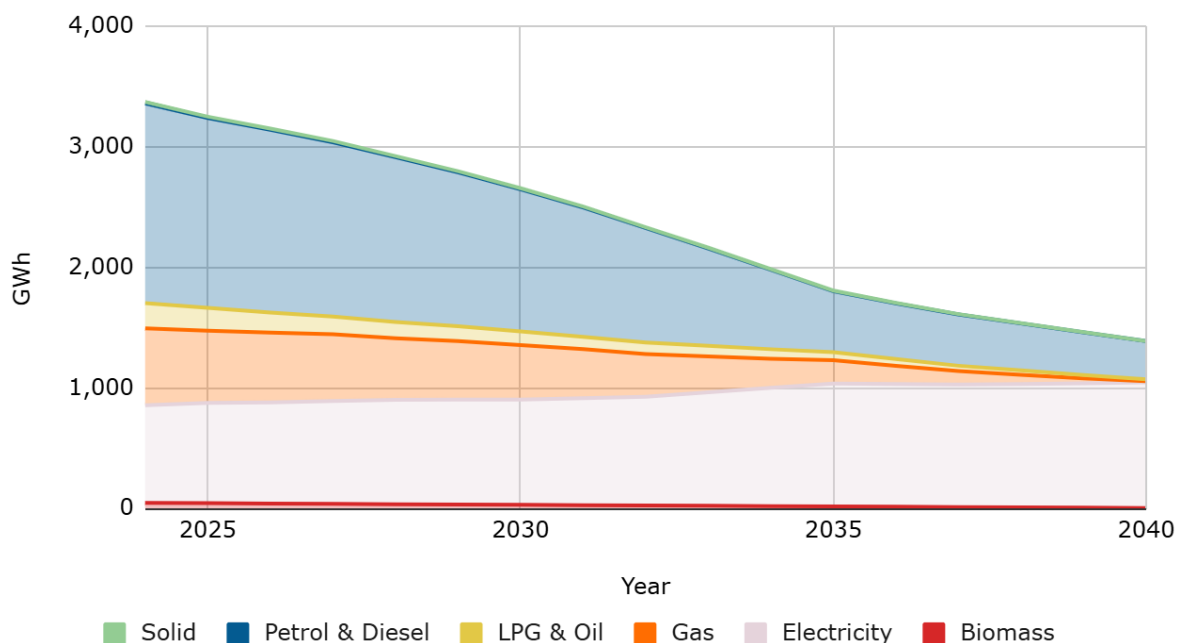


Figure 52: Annual fuel demand in the Medium Ambition scenario, segmented by fuel type.

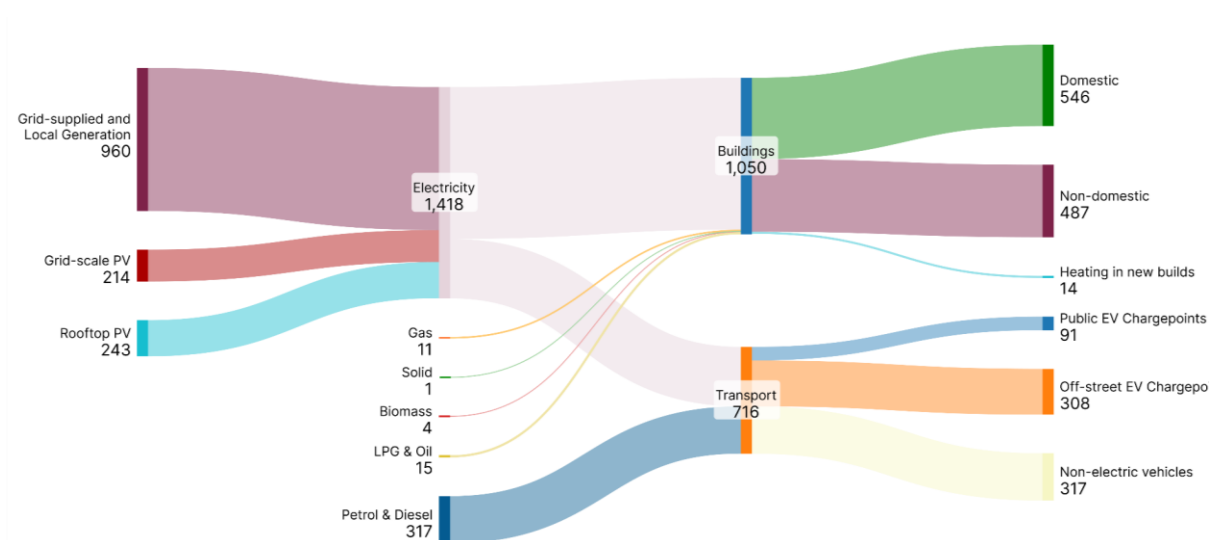


Figure 53: Characterisation of fuel source and demand in final year of the Medium Ambition scenario (in GWh).

Local generation can help to reduce demand for electricity imported from other areas outside the Winchester district and increase energy self-sufficiency. The graph below reflects the potential volume of demand that could be met by locally generated power, mostly coming from photovoltaics - both rooftop and ground mounted. This represents generation that, in principle, reduces the amount of electricity that would otherwise need to be supplied from the wider grid, assuming it is available at the point it is needed.

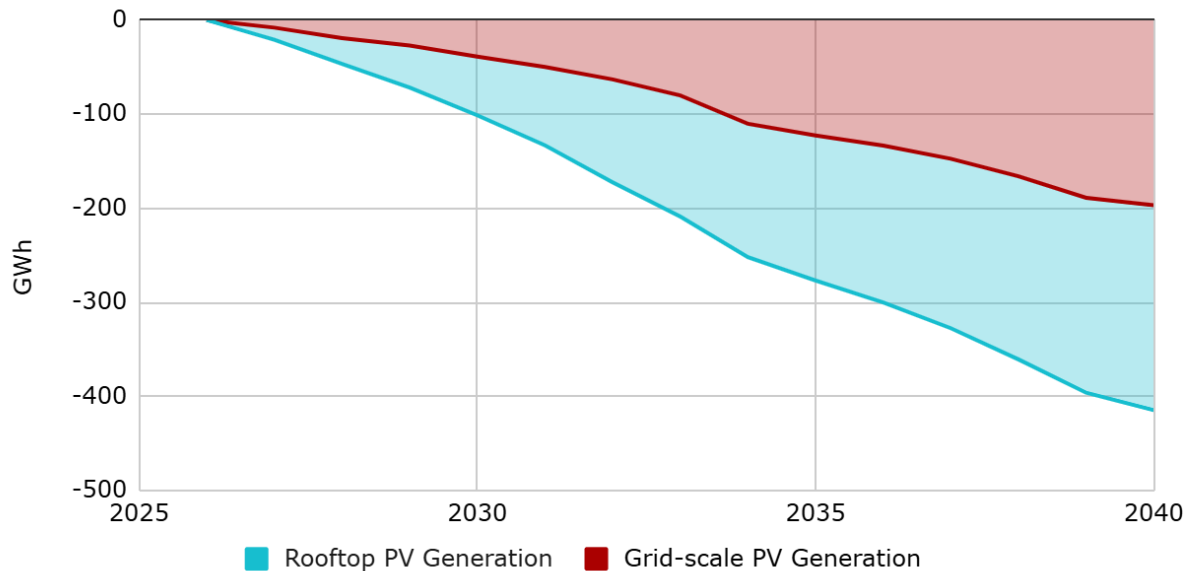


Figure 54 : Annual electricity demand met by local renewable generation in the Medium Ambition pathway

6.3 Carbon Emission Reduction

6.3.1 Carbon Emissions across Scenarios

All scenarios start from a baseline published by the Department for Energy Security and Net Zero (DESNZ) (most recent year published 2023) and given earlier in Section 1.2 Emissions and Targets. Unlike in Section 1.5, emissions from rail, agriculture and waste are excluded here as these are not in scope for the LAEP.

Table 9: Baseline Carbon Emissions*

DESNZ fuel type	Domestic	Non-domestic	Total (ktCO ₂ e)
Electricity	39.7	57.4	97.1
Gas	92.4	34.1	126.5
Petrol cars total	-	-	118.4
Diesel cars total	-	-	108.2
Electric vehicles total	-	-	7.1

Other Transport	-	-	161.4
Other	27.3	30.9	58.2
Total	159.4	122.4	676.9

*Excludes rail, agriculture and waste

Carbon emissions see initial rapid reduction across all scenarios as quicker wins result in dramatic decreases, such as the shift away from petrol and diesel vehicles and installation of low carbon heating on well insulated homes. The rate of decrease begins to slow across all scenarios from around 2035 as efforts now need to focus on harder to decarbonise areas, such as industrial and non-domestic processes.

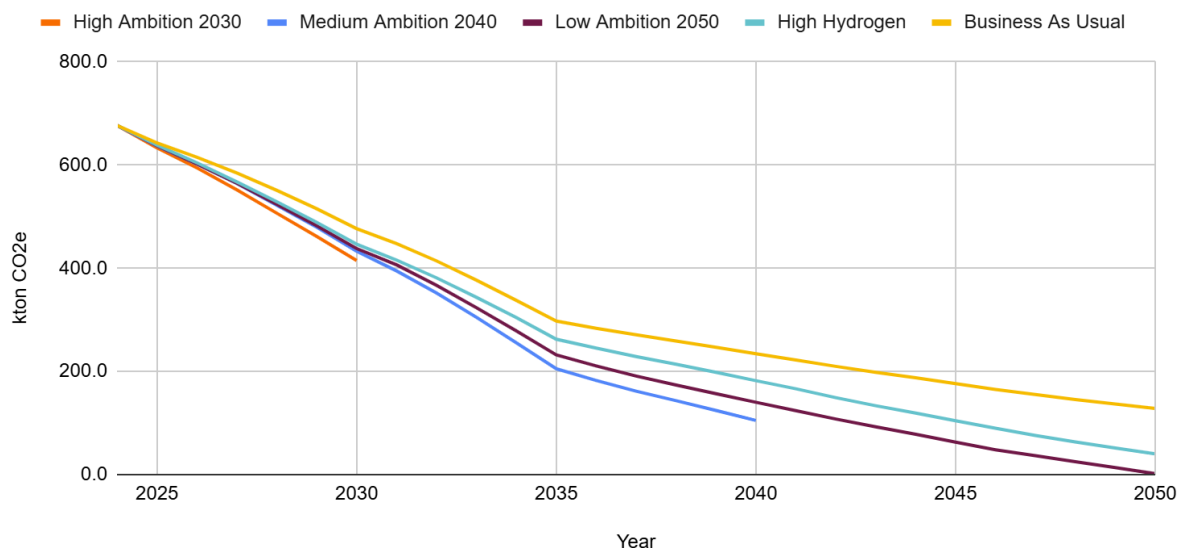
Low Ambition reaches net zero by 2050.

High Hydrogen is policy-dependent and the potential emission factor of hydrogen may mean this scenario cannot reach net zero. In our modelling we have assumed an emission factor emerges which is in line with the UK Low Carbon Hydrogen Standard of 0.072kgCO₂e/kWh. However, achieving this for hydrogen generation at the scale needed to replace gas is very challenging which - alongside safety uncertainties - suggests this scenario should not currently be relied upon.

High Ambition, while demonstrating potential acceleration rates, does not reach net zero by 2030. Business as Usual evidences the gap if very limited action is taken.

Medium ambition could plausibly reach net zero by 2040 and is discussed in more detail in section 6.3.2.

Across all scenarios the reduction in the national carbon intensity of electricity contributes to overall reduction as national projections reduce this from a baseline of 126gCO₂/kWh (the 2025 national average) to below 50gCO₂/kWh by 2030 (in line with the UK Government's Clean Power Plan) and significantly lower by 2040/50.



*Excludes rail, agriculture and waste

Figure 55: Carbon emission reductions compared across each scenario pathway.

6.3.2 Emissions in the Medium Ambition (2025-2040) Scenario

Emissions reduction is closely coupled with changes in fuel demand and energy supply. In **Medium Ambition**, this change means most core targets can be met by 2040 - such as decarbonising domestic heating, most non-domestic processes and a significant amount of transport emissions.

Based on recommended measures, the fuel demand in this scenario is characterised by overall decrease in energy demand and a sustained increase in electricity demand, mainly driven by electric heating installations and the electrification of transport. The higher deployment of less efficient alternative electric heating technologies like resistive heating also increases this growth in electricity demand as these consume more power relative to heat pumps, but are able to be deployed faster due to greater ease of installation and often lower CAPEX costs leading to an overall more rapid rate of decarbonisation than the Low Ambition scenario. Emissions see modest increase from new builds, but these don't affect the overall downward trend in emissions, especially as these are more energy efficient than older housing stock. By year 2040, the yearly emissions from new builds are 2.5ktCO₂e/year, minus their corresponding emissions reduction from PV generation.

Energy supply shifts both locally and nationally result in further emission decreases as the carbon intensity of the national grid reduces and local PV generation increases across ground mount and rooftop installations. The reduction of carbon emissions from PV each year is estimated at 80.9ktCO₂e in the final year of the scenario (2040) - equivalent to reducing around 10.5% of the baseline year's emissions.

By 2040 some residual emissions may remain across all scenarios, including Medium Ambition, due to ongoing use of older petrol and diesel cars purchased before 2030, as well as a minor use of fossil fuels in some non-domestic processes. National and local interventions like storage, carbon capture and sequestration can further support the offset of residual emissions. Some of these may be developed locally, but many are also likely at a national level.

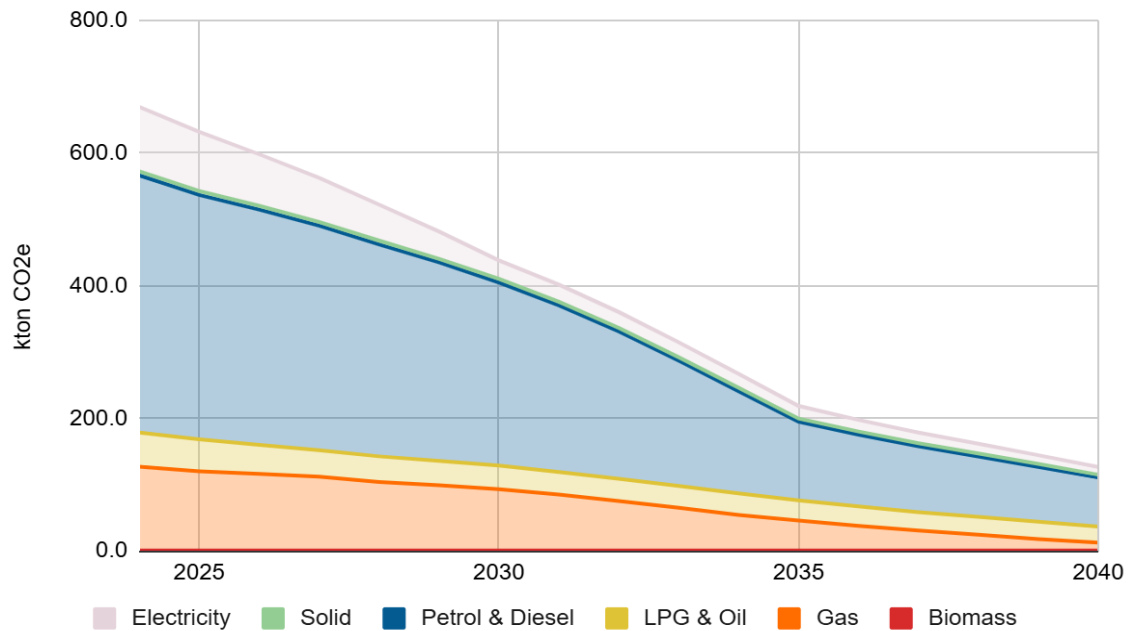


Figure 56: Annual Emissions by Fuel Type in the Medium Ambition (2025-2040) Scenario

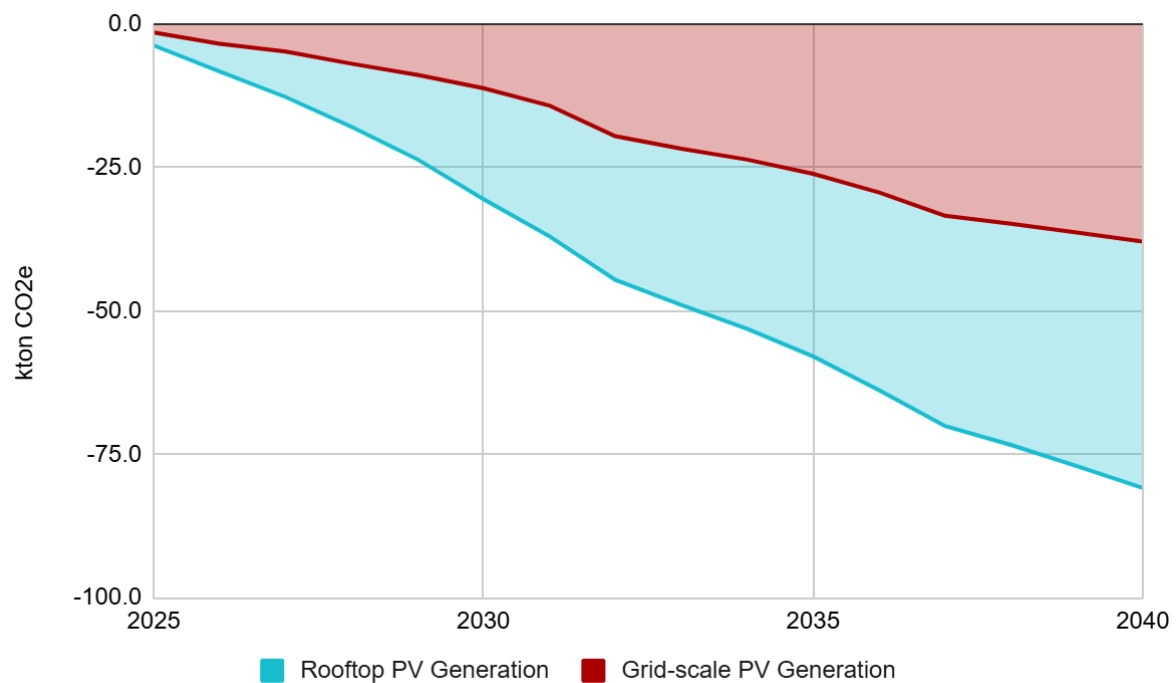


Figure 57: Annual Emissions Reduction by local PV generation in the Medium Ambition (2025-2040) Scenario as the grid decarbonises

6.4 Electricity Grid Readiness

Understanding grid readiness is essential to ensure that projected electrification of heat, transport and distributed generation can be delivered. Identifying where headroom would likely reduce or become negative without intervention enables Winchester City Council and Scottish and Southern Electricity Networks (SSEN) to plan flexibility, reinforcement and sequencing of interventions in a coordinated and proactive manner.

If available headroom is exceeded, the network may be unable to accommodate additional demand or generation within existing capacity limits. This can lead to thermal overloading of network assets, increased risk of faults or outages, and reduced reliability of supply. On the generation side, limited export capacity may result in curtailment of distributed energy resources, reducing their effective utilisation.

Winchester is served by 1,673 secondary substations, the majority of which (1,302) have sufficient demand headroom for additional load, with only a small proportion operating close to or above capacity. Across all secondary substations, average demand headroom is 63.56%. Above this level sit the primary substations: Winchester has 30 primaries in total, although only a subset lie predominantly within the district boundary, with others - such as Botley Wood and Fernhurst - extending only marginally into Winchester's area. Most primaries are operating comfortably within demand limits, with only a small number showing constrained headroom. At the top of the hierarchy are the Bulk Supply Point (BSP) substations, of which 13 intersect the district. BSPs serve much larger geographic areas and feed multiple primaries, so only parts of some BSP zones—such as Velmore, Botley Wood and Netley Common - fall within Winchester. Understanding this relationship between BSPs, primaries and secondaries is important, as constraints at higher-voltage levels can influence the capacity available downstream, even where local secondary substations appear unconstrained.

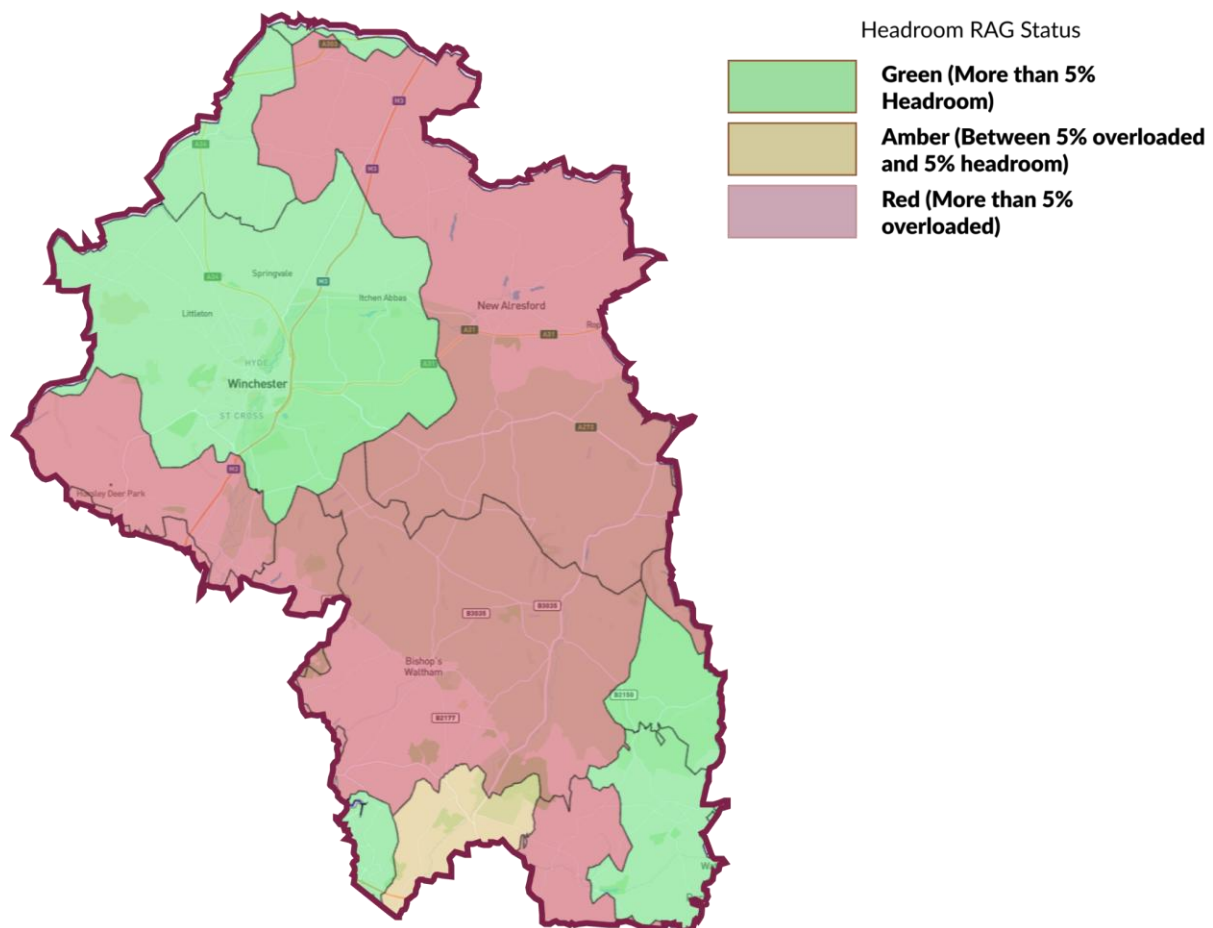


Figure 58: A Map of All Bulk Supply Point Substations in Winchester

Bulk Supply Point (BSP), primary demand and generation headroom analysis has been undertaken to identify how available capacity may change under the recommended Medium Ambition 2040 pathway.

This pathway is technically deliverable only with early and coordinated engagement with SSEN in the most constrained areas. Significant constraints emerge very early in demand headroom, with generation constraints projected from the 2030s. Targeted flexibility deployment, staged interventions and reinforcement planning will be essential to maintain alignment between decarbonisation ambition and network readiness.

6.4.1 Demand Headroom

Demand headroom is the availability of the network to support new demand, such as heat pumps, EV chargepoints and new developments. This report considers demand headroom at two key voltage levels: BSP and Primary.

BSP demand headroom analysis shows that several supply points begin in deficit, with conditions worsening across the pathway. Winchester shifts from a positive baseline (+17.3 MVA) into deficit by the year 2027 and declines sharply to around -150.8 MVA by 2040, representing one of the most severe upstream constraints due to sustained pressure from primaries such as St Cross, Harestock, and Gordon Road. Netley Common also starts in deficit (-8.3 MVA) and deteriorates steadily to around -83.6 MVA by 2040, mirroring the severe pressures at Bishops Waltham and the negative baseline at Netley Common 11 kV. Wymering and Velmore remain persistently negative from the outset, while Rownhams, Fernhurst, and Fareham show sustained and worsening deficits, indicating continued upstream strain. Alton BSP also remains in deficit throughout, reflecting the trajectory at Alresford despite planned works. Overall, the results indicate that upstream constraints are already present at baseline and intensify significantly by 2040—particularly at Winchester and Netley Common - highlighting the need for early coordination with the DNO at both primary and BSP levels.

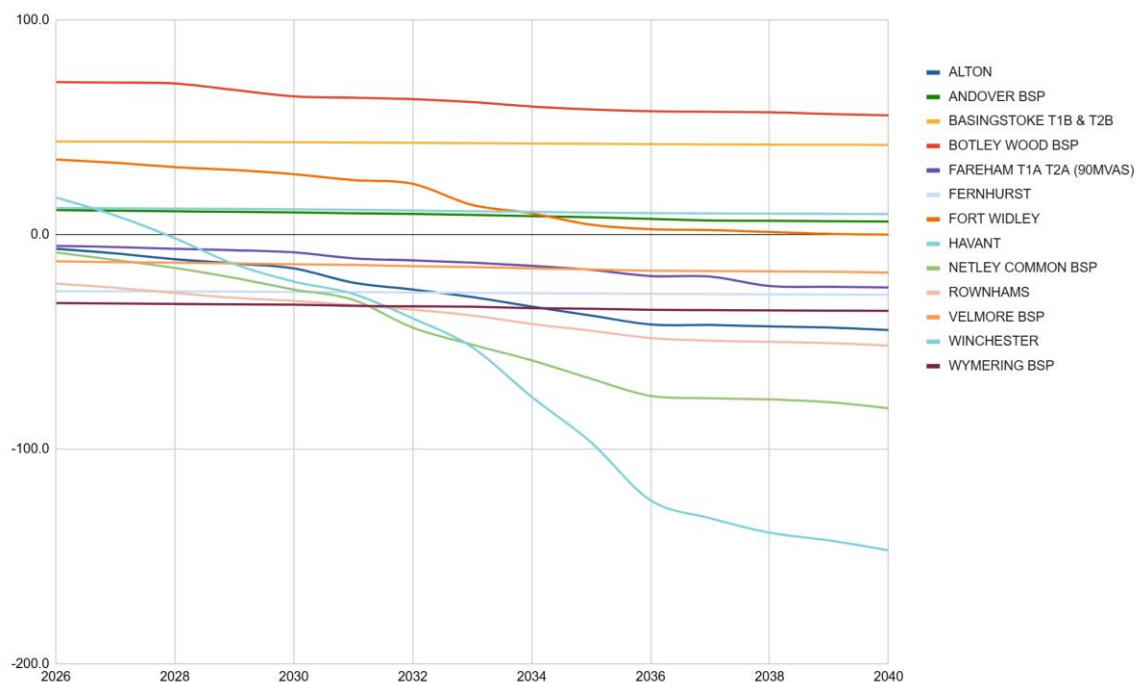


Figure 59: Bulk Supply Point (BSP) Substation Demand Headroom Changes

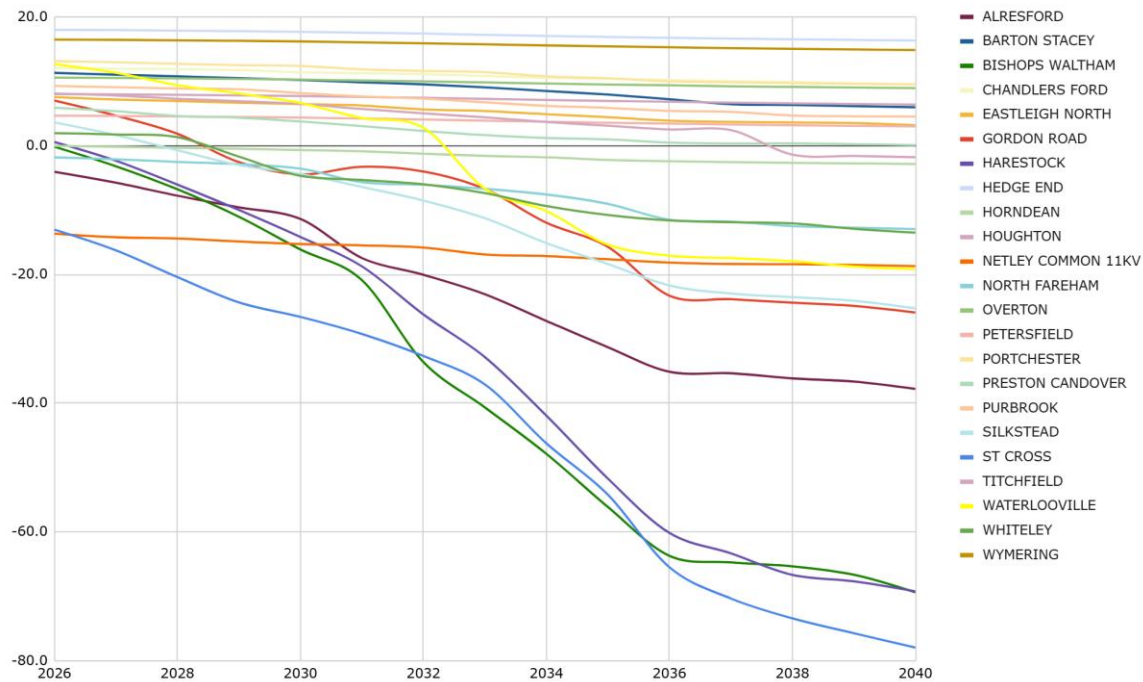


Figure 60: Primary Substations Demand Headroom Changes

Several primary substations are already constrained from 2026, with conditions worsening along the pathway. Alresford (around -4 MVA), St Cross (around -13 MVA), and Netley Common 11 kV (around -13.6 MVA) begin in deficit, indicating pre-existing pressure before further electrification. Across the wider area, Bishops Waltham and St Cross experience the most severe and persistent deficits, reflecting structural demand pressure that will require early, substantive intervention. Project demand growth in Harestock would also rapidly trigger constraints, and together these substations represent the highest-priority demand-risk locations for the area.

SSEN is proactively engaging with stakeholders, LAEPs and forecasts to address constraints. For example, Alresford's initial deficit (around -4 MVA) is expected to be temporarily relieved by the planned 11 MVA release in 2028, as noted in the SSEN Distribution Network Options Assessment (DNOA) report. While this would restore short-term headroom, projected demand growth suggests the benefit will be short-lived unless flexibility measures or further reinforcement follow.

6.4.2 Generation Headroom

Generation headroom is the availability of the network to support new generation exports, such as PV from both rooftop and ground mount installations) and wind.

At BSP level, export headroom reductions reflect cumulative generation growth. Winchester BSP deteriorates substantially during the 2030s due to PV growth at St Cross, Harestock, and Gordon Road, and already has less available headroom than downstream primaries. Andover BSP is similarly affected by growth at Barton Stacey and Whitchurch. These trends indicate that export constraints extend beyond individual primaries and may require upstream reinforcement, export-management schemes, or coordinated flexibility.

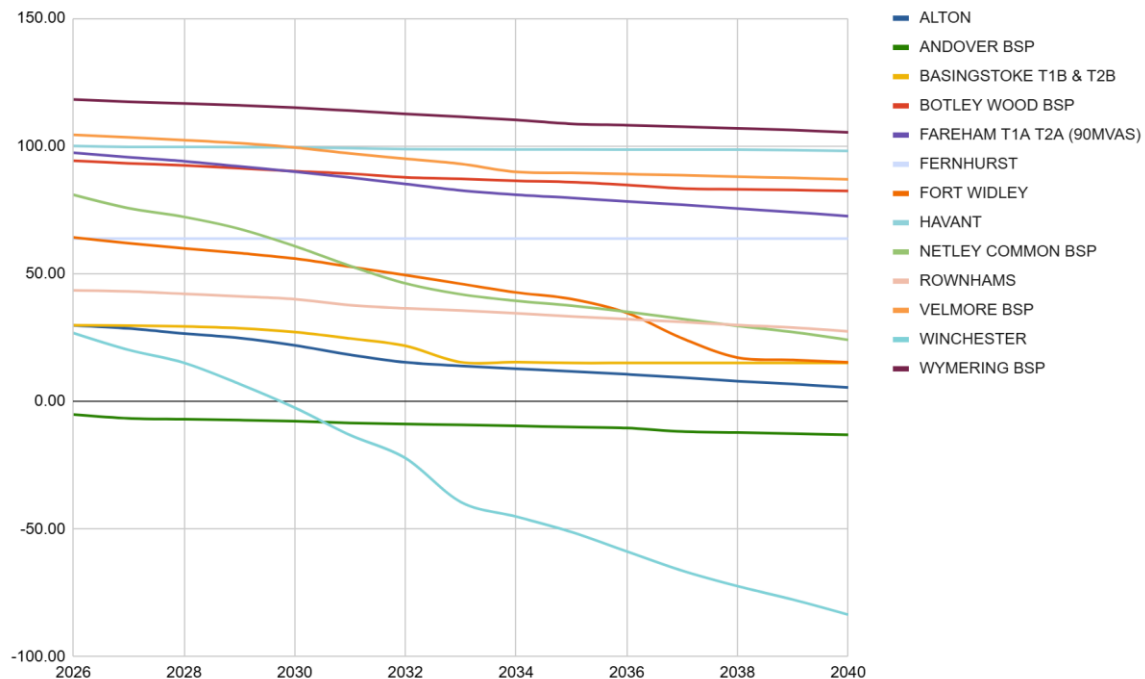


Figure 61: Bulk Supply Point (BSP) Substation Generation Headroom Changes

At the primary substation level, Alresford and Bishops Waltham, already constrained on demand, would also develop generation deficits without interventions, reaching -12.4 MW and -31.2 MW by 2040, with 20–25% from large-scale generation units and the remainder from rooftop PV. Additional deficiencies occur at Preston Candover, which remains negative throughout; at Silkstead, where export headroom reduces sharply and becomes negative; and at St Cross and Harestock, which move into deficit later in the pathway. These areas show severe or sustained export limitations, increasing the risk of curtailed PV or delayed generation projects without active network management or reinforcement.

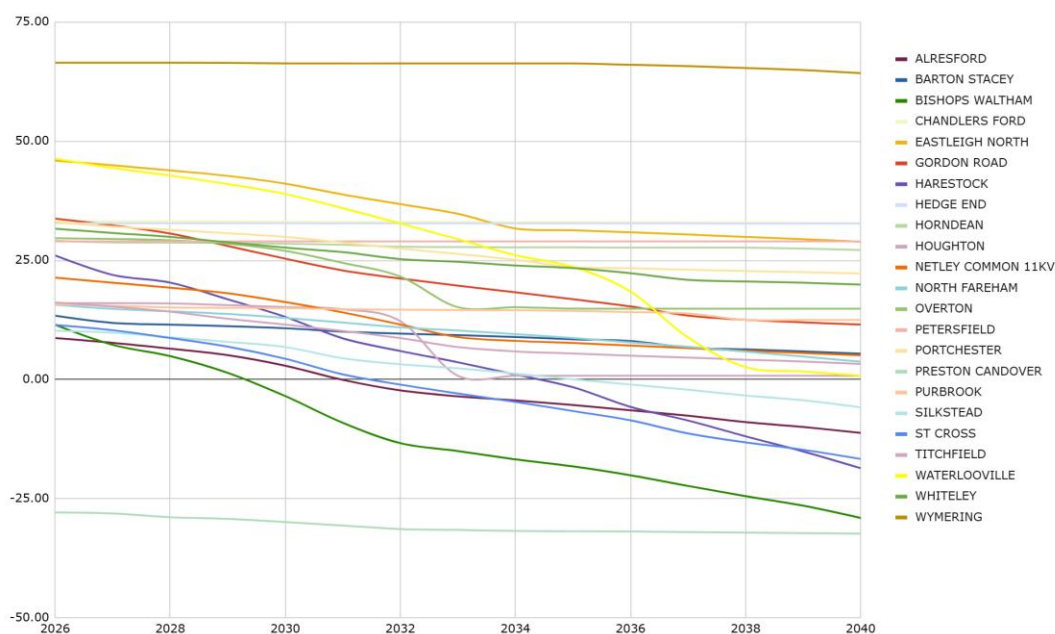


Figure 62: Primary Substations Generation Headroom Changes

6.4.3 Main Risk Areas

Risk Area	Substations Affected	Timeframe	Detail
Critical Dual Constraint (Immediate & Structural)	Harestock, St Cross, Bishops Waltham (Primary) → Winchester, Netley Common (BSP)	Baseline to Year 2028	These substations experience early and persistent pressure, with demand headroom falling rapidly into deep deficit. By 2040, demand shortfalls reach approximately -70 MVA at Harestock, -79 MVA at St Cross, and -72 MVA at Bishops Waltham, indicating entrenched structural constraints. Generation headroom also deteriorates sharply, with export deficits of around -22 MW at Harestock, -31 MW at Bishops Waltham, and below -90 MW at Winchester BSP. The combination of early-onset and dual-sided constraints signals the need for immediate intervention, including early SSEN engagement, deployment of large-scale flexibility, coordinated EV and heat-pump management, community storage solutions, and accelerated BSP-level reinforcement planning.
Severe Demand with Escalating BSP Impact	Netley Common 11 kV, Whiteley, Waterloo, Alresford, Silkstead (Primary) → Netley Common BSP; Alton BSP; Rownhams (BSP)	Years 2028-2031	These substations show a strong negative demand trajectory, with deficits deepening to around -19 MVA at Netley Common 11 kV, -14 MVA at Whiteley, -40 MVA at Alresford, and -26 MVA at Silkstead. Generation constraints emerge mid-pathway, most notably at Alton BSP, which becomes export-negative from approximately 2030. The pattern indicates escalating upstream pressure that will intensify without intervention. Recommended actions include structured flexibility deployment, alignment with planned DNO works, and targeted BSP-level capacity assessments to manage the growing constraints.
BSP-Driven Constraint Areas	Winchester, Netley Common, Rownhams, Alton (BSP)	Early pathways	In these areas, constraints originate primarily at the BSP level rather than individual primaries. Demand headroom deteriorates significantly, with Winchester falling below -150 MVA, Rownhams below -50 MVA, and Alton below -45 MVA by 2040. Generation headroom also declines materially, with Winchester dropping below -90 MW and Alton becoming export-negative mid-pathway. These trends point to structural upstream limitations requiring area-wide demand management, coordinated flexibility measures, and formal BSP-level reinforcement option appraisal.
Localised Emerging Constraints	Preston Candover, Titchfield, Chandlers Ford (Primary) → Andover, Fareham T1A/T2A; Velmore (BSP)	Years 2033-2037	These substations show gradual deterioration in demand headroom, with some moving into marginal or slightly negative positions in the later years. Generation impacts are generally limited or moderate, although Preston Candover remains in persistent export deficit throughout the pathway. Given the slower rate of decline, these areas are best managed through ongoing monitoring, trigger-based intervention, and targeted flexibility rather than immediate reinforcement.
Stable / Monitor-Only Areas	Hedge End, Petersfield, Portchester, Wymering, Eastleigh North, Houghton (Primary)	No trigger within pathway	These substations maintain stable or positive demand headroom throughout the assessment period and retain strong generation headroom, with Wymering BSP remaining above 100 MW. With no material constraints emerging, these areas require only continued monitoring under a standard oversight framework.

	- Velmore BSP; Wymering BSP; Fernhurst (BSP)		
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New Builds Network Assessment

The Medium Ambition pathway includes a significant contribution from new developments, modelled as additional electrified heat, EV charging infrastructure and rooftop PV installations. Domestic developments are expected to develop in line with government targets for Winchester at 1,157 properties per year. As the precise spatial allocation of these developments is not yet defined at BSP or Primary level, they have been treated as a standalone category ("New Builds") and not assigned to specific substations.

As a result, the BSP and primary headroom figures for New Builds are identical, reflecting their unallocated status within the network hierarchy. The projected impact is substantial. On the demand side, an additional 126.9 MVA demand headroom is required by 2040, driven primarily by rapid growth in EV charging capacity and heat pump deployment. EV charging forms the dominant share of incremental peak demand, with heat pumps providing an additional sustained winter peak contribution.

On the generation side, cumulative rooftop PV deployment from new developments progressively requires additional export headroom, up to -86.3 MW by 2040.

Until development locations are confirmed and allocated to specific BSP and primary areas, these impacts should be flagged as system-wide additional pressure. This introduces uncertainty into substation-level projections and reinforces the importance of early coordination between spatial planning and network capacity assessment.

6.5 Decommissioning the Gas Network

Under both the Medium Ambition (2040) and Low Ambition (2050) scenarios, full electrification of space heating is projected, resulting in the complete removal of gas demand across the Low Pressure (LP) and Medium Pressure (MP) distribution network by the respective scenario end date. In these pathways, the LP and MP networks are assumed to be subject to total decommissioning.

The total pipe decommissioning liability under these scenarios is estimated at £55.3 million, comprising approximately £45.4 million associated with LP assets and £9.9 million associated with MP assets. The predominance of LP cost reflects its substantially greater network coverage. Higher unit costs are concentrated in larger diameter metallic gas mains, typically located along primary carriageways and established urban corridors, where full removal is required. In contrast, a significant proportion of the network, particularly polyethylene and smaller diameter assets, is addressed through lower-complexity in-situ abandonment methods.

The cost profile reflects a blended intervention approach. Approximately 75% of total decommissioning expenditure is associated with in-situ cut-and-cap interventions, reflecting the prevalence of polyethylene and smaller diameter assets across the network. In contrast, full removal accounts for approximately 6% of total cost, despite its significantly higher unit rate, due to its application being limited to larger-diameter metallic mains. Average costs vary materially by pipe material and pressure tier, reflecting differences in diameter, structural behaviour and required traffic management intensity.

While electrification delivers substantial carbon reduction and aligns with national net-zero objectives, the results highlight that full transition away from gas also introduces a significant infrastructure decommissioning liability. The £55.3 million figure represents a material asset exposure that must be considered alongside the decarbonisation benefits of the pathway. In practice, the cost of decommissioning could likely be shared across several parties - potentially including the gas network operator, central government and the wider regulatory framework - reflecting how national policy ultimately allocates responsibilities for end-of-life gas infrastructure. Key assumptions and uncertainties include the absence of detailed ground condition data, congestion impacts, programme sequencing constraints and coordination requirements with the Gas Distribution Network operator. The estimate should therefore be interpreted as a strategic planning baseline, illustrating both the decarbonisation benefits and the consequential infrastructure costs associated with full electrification.

| 7 Next Steps

The Local Area Energy Plan research has identified plausible routes and conditions to achieve net zero for Winchester. The next steps are turning this strategic spatial plan into a pipeline of delivery projects as laid out in Section 5 Implementation. Possible action points for the council are outlined below.

Improve Energy Efficiency

Whilst progress is already being made across council building stock, the average EPC rating for domestic properties across Winchester is D meaning substantial improvements are required. Winchester Council can enable this by reviewing funding plans, suppliers and developing advice services for businesses and consumers. In the short term, focussing on homes that qualify for existing funding schemes, such as Warm Homes may be beneficial.

Decarbonise Heat

Like the rest of the UK, the majority of heating and cooking in Winchester relies on gas. A shift away from this is essential across any net zero scenario. Whilst much of this transition will ultimately be driven by home-owners, businesses and market drivers - the council can facilitate the development of heat networks and could develop an advice function for electric heating. The council can also lead the way through the decarbonisation of its own building stock.

Decarbonise Transport

Winchester already has a slightly higher per capita deployment of public EV charging compared to the national average. However, significant increase in private and public charging infrastructure will be needed to facilitate the transition away from petrol and diesel vehicles. Winchester and Hampshire councils can support this, especially in areas not yet well served by public EV infrastructure and in areas where residents lack access to off-street parking to charge at home.

Maximise Renewable Generation and Storage

Winchester currently has ~93MW of renewable generation across large scale and domestic assets. All scenarios rely on increasing this significantly to provide low carbon energy locally. The council can facilitate this by engaging with developers and local groups, such as schools and businesses, to facilitate uptake.

Cross Cutting Enablers

Developing an advice function over the next few years, engaging and supporting community groups will facilitate delivery across all intervention areas. Likewise engaging proactively with energy networks will help ensure capacity is available at the right time and in the right place to avoid unnecessary costs or delays.

List of Acronyms

Term	Definition
AITL	Advanced Infrastructure Technology Limited
ASHP	Air Source Heat Pump - a heating system that extracts heat from outside air
CCC	Climate Change Committee
DESNZ	Department for Energy Security and Net Zero
DFES	Distribution Future Energy Scenarios. Produced by all Distribution Network Operators in the UK. These are based on the FES scenarios published annually by Ofgem.
DfT	Department for Transport
DNO	Distribution Network Operator - company that owns/operates electricity distribution networks
DNOA	Distribution Network Operator Assessment - published by electricity distribution network operators (DNOs) to transparently outline how they plan to manage network capacity needs.
FES	Future Energy Scenarios, published annually by Ofgem. These four scenarios provide a view of a range of future pathways for the whole energy system, exploring a range of routes to net zero in 2050 for energy demand and supply.
EPC	Energy Performance Certificate - a rating of a property's energy efficiency
EV	Electric Vehicle
EVCP	Electric Vehicle Charge Point
GSHP	Ground Source Heat Pump - heating system using ground heat via buried pipe loops
LAEP	Local Area Energy Plan - a strategic plan for local energy systems
LENZA	Local Energy Net Zero Accelerator
LSOA	Lower Layer Super Output Area - small geographic unit for UK statistics
MCS	Microgeneration Certification Scheme - UK standards for low-carbon installations
MSOA	Middle Layer Super Output Area - medium-sized geographic statistical unit in the UK
NEVIS	National Electric Vehicle Insights and Support
NGD	National Geographic Database
OS	Ordnance Survey - national mapping agency of Great Britain
PV	Photovoltaic - solar electricity-generating technology
SAP	Standard Assessment Procedure - UK methodology for assessing energy efficiency of buildings
SGN	Scotia Gas Networks (now SGN) - gas distribution network operator.
TOID	Topographic Identifier - a unique ID for Ordnance Survey geographic features.
UPRN	Unique Property Reference Number - a unique identifier for every addressable location in the UK.
ZEV	Zero Emission Vehicle

| Units

Term	Definition
kWh	Kilowatt-hour - a unit of energy measuring electricity consumption over time
kWp	Kilowatt-peak - the maximum output of a solar PV system under standard test conditions
MW	Megawatt - a unit of power equal to 1,000 kilowatts
MVA	Megavolt-ampere – a unit of apparent power used for electrical equipment and grid capacity, representing the combined effect of voltage and current.
GW	Gigawatt (GW) – a unit of power equal to 1,000 megawatts (or one billion watts).
GWh	GWh (Gigawatt-hour) – a unit of energy representing one gigawatt of power sustained for one hour.
tCO ₂ e	Tonne of carbon dioxide equivalent (tCO ₂ e) – a unit measuring greenhouse gas emissions, expressed as the equivalent amount of CO ₂ .

Winchester LAEP

Assumptions & Methodology Report

Scottish & Southern
Electricity Networksai advanced
infrastructure

| 1 The Current Energy System

The current energy system baseline is a condensed summary of the wider Winchester LAEP Baseline Report. Most underlying datasets are available through the LENZA platform. Building archetype analysis (Section 2.1) is derived from the OS AddressBase Premium dataset viewable via LENZA. Energy demand draws on multiple sources: gas consumption figures are taken from DESNZ datasets available on the platform, while electricity consumption is based on Subnational Electricity Consumption Statistics. MCS installation data is sourced from the MCS Dashboard, which provides a domestic and non-domestic breakdown, whereas LENZA presents this dataset at a more aggregated level. The count of existing rooftop PV installations across domestic and non-domestic buildings is obtained through Ordnance Survey. As this source provides count but not capacity, the baseline estimate of rooftop PV capacity is based on an assumed average array size of 6.1kW.

| 2 Scenario Modeller Methodology

2.1 Sorting Algorithm Overview

The modelling method for domestic and non-domestic buildings uses a prioritisation and exhaustion approach to define which technologies should be installed first in any given year. First, premises are assigned points depending on whether or not they meet the priority criteria of each scenario.

The premises are then ranked based on the number of points that they have, in such a way that the premises with higher number of points receive installations first. If a scenario does not have priorities assigned to it, then all the premises are considered within the same rank.

The installations are then selected on the basis of a cost-benefit analysis. The lifetime benefit of every technology is calculated on a basis of 10 years. Therefore, for every potential installation in every premise, the net benefit is calculated as follows:

$$\text{Net benefit} = \text{Technology lifetime} * \text{Yearly benefit} - \text{Total cost} = 10 * \text{Yearly benefit} - \text{Total cost}$$

The individual installations are then sorted by their net benefit so that the installations with higher net benefit are installed first. Finally, the algorithm assigns installations year by year following the deployment rate cap curve, assigning installations in high priority premises first and starting with those with higher net benefit.

2.2 SAP Benefit Overview

The yearly benefit for most technologies is calculated based on the energy saving that it can deliver at a given premise, based on the results of the Standard Assessment Procedure (SAP) on different property archetypes.

Domestic premises are classified into 80 archetypes following four age band bins (Before 1930, 1930-1964, 1965-1990, 1991 onwards), five property types (Detached, Semi-detached, Self Contained Flat, Terraced, and Other) and four premise areas ([0-73) m², [73-98) m², [98-200) m², >= 200 m²), matching those in the Ofgem ECO4 Delivery Guidance v3.0.

10 million domestic Energy Performance Certificates (EPC) were then analysed from both the Scotland and England/Wales repositories to calculate the typical energy savings of each technology separately on each archetype.

Since non-domestic buildings have different considerations in the way that they are modelled in SAP, the archetype approach is not adopted for them and the optimisation to determine non-domestic installations is done exclusively on the basis of technology cost.

2.3 Installation constraints

The installations by year are constrained in the following order:

- 1) By feasibility of installation
- 2) By targets
- 3) By deployment cap rates

	2050	2030	2040	2050	2050
	DO NOTHING	HIGH AMBITON	MEDIUM AMBITON	LOW AMBITON	HIGH HYDROGEN
DOMESTIC					
Cavity Wall Insulation	—	76%	76%	76%	76%
Loft Insulation	—	82%	82%	82%	82%
Under Floor Insulation	—	40%	40%	40%	40%
External Wall Insulation	—	20%	20%	20%	20%
ASHP	—	80%	80%	80%	60%
GSHP	—	10%	10%	10%	5%
Heat Network	—	5%	5%	5%	5%
Hydrogen Boiler	—	—	—	—	30%
Rooftop PV	—	60%	60%	60%	53%
NON-DOMESTIC					
ASHP	—	60%	60%	60%	40%
GSHP	—	10%	10%	10%	5%
Heat Network	—	5%	20%	25%	15%
Hydrogen Boiler	—	—	—	—	30%
Rooftop PV	—	60%	60%	60%	52%

Figure 1: Targets set by Winchester City Council

Winchester City Council grounded the above technology specific targets in a detailed review of local energy data, including baseline renewable generation, solar PV deployment, insulation levels, and heating system characteristics. Targets were made to align with national policy expectations, Climate Change Committee guidance, and the council's own 2030, 2040, and 2050 net-zero ambitions, shaping clear pathways for heating, solar, and EV charging. However, it should be noted that missing a target above does not necessarily equate to missing net zero altogether as sufficient emissions reductions can be achieved without achieving all targets given above.

The deployment rate cap is a technology specific cap on the maximum year-on-year increase in deployment that can be realistically achieved. This can be understood as the assumed maximum possible uptake rate for a given scenario. This figure is based on: 1) historic installation rates for Winchester, measured through resources like the MCS register (2009-2025) and 2) assumptions about reasonable year-on-year growth based on heuristic assessments and comparison with national projections like the Future Energy Scenarios (FES):

- The High Ambition scenario is assumed to achieve the highest year-on-year growth. This rate slightly exceeds the rate of growth in FES and DFES scenario projections for most technologies. This is a highly ambitious rate which would require significant effort from the council and other local actors to be realised.
- The Medium Ambition scenario aligns closely with the national FES projections and local DFES projections for an ambitious but plausible rate of increase in technology adoption.
- High Hydrogen uses similar caps to Medium Ambition for all technologies except hydrogen. In this scenario, hydrogen is assumed to become possible more widely from the 2030s with a maximum annual uptake rate of 10%.
- The Low Ambition scenario has lower year-on-year growth than all other scenarios, reflecting the reduced ambition.
- Business as usual assumes uptake rates differ little from historic installation rates, with moderate increases from already committed national and local policy decisions (e.g. Future Homes Standard).

2.4 Business as Usual Scenario

The Business as Usual scenario represents the decarbonisation measures with confirmed commitments and implementation plans scheduled between now and 2050. It serves as the baseline against which all other scenarios are assessed. Unlike the other scenarios, it is assumed that limited increases are achieved against the current deployment rate for all technologies modelled.

To establish current deployment levels, MCS installation data was analysed for both domestic and non-domestic properties. Historical installation trends were used to calculate the average annual deployment rate for each technology. These technology-specific trends were then extrapolated forward to 2050 to form a projection of future uptake under a continuation of existing commitments only. This approach ensures that the Business as Usual scenario reflects a realistic, evidence-based trajectory of technology adoption, absent any additional interventions, incentives, or policy accelerations beyond those already confirmed.

| 3 Insulation

Insulation characteristics are derived using a hybrid actual-inference approach. Where EPC-derived insulation data is available, these values are retained. Where insulation fields are unknown, a structured inference process is applied to assign representative insulation states. For properties with missing insulation information, wall, roof and floor insulation types are inferred using a constrained archetype mapping methodology. Buildings are first normalised by simplified property type, construction age band and primary heating fuel. These attributes are aligned to regionally filtered residential archetype data for South England to ensure contextual relevance.

For each unique property type-age-fuel combination, a representative archetype is selected and associated construction attributes (wall, roof and floor types) are mapped to insulation states (Insulated, Uninsulated or Not Applicable).

| 4 Heating

4.1 Overview

The heating methodology employs a prioritised approach that accounts for spatial clustering and technology deployment practicalities. Unlike other low carbon technologies where individual building-level optimisation is appropriate, some types of heating infrastructure requires coordinated deployment within geographical areas to achieve economies of scale and network efficiency.

4.2 Technology Prioritisation

Heating technologies are assessed in the following order:

1. District Heating (where suitable)
2. Heat Pumps (Air Source and Ground Source)
3. Hydrogen Boilers (from 2035 onwards)

This sequencing reflects infrastructure dependencies and technology readiness. Heat networks require concentrated heat demand to be economically viable, whilst hydrogen boiler deployment is deferred until 2035 as the earliest plausible date this may become available. All heating systems are mutually exclusive – each building can only receive one heating technology.

4.3 Heat Network Assessment

Heat network suitability is determined using heat network zones identified by the Department for Energy Security and Net Zero's (DESNZ's) zoning study. Early outputs for Winchester were shared by DESNZ for use in Winchester's LAEP, with the caveat that these zones may be subject to change in future runs of the model. Properties within these zones are ring-fenced for district heating consideration and excluded from heat pump or hydrogen boiler deployment as the zoning model is based on an assessment of areas where heat networks are the cost-optimum route forwards. Unlike the building-level benefit-cost ranking used for other technologies, district heating is assessed at the heating zone level. The SAP benefit minus installation costs is aggregated for all suitable properties within each zone. Zones are then ranked by their total aggregated benefit, with higher-ranking zones prioritised for deployment. This zonal approach ensures deployment in the model reflect actual behaviour whereby an entire zone of buildings will transition as one, once ready.

4.4 Heat Pump Deployment

For properties outside district heating zones, Air Source Heat Pumps (ASHP), Ground Source Heat Pumps (GSHP) and alternative heating technologies like resistive heating are evaluated together using the standard benefit-cost methodology. For each building, both ASHP and GSHP options are assessed, with the technology offering the higher score selected. For buildings that are harder to decarbonise using heat pumps, alternative less efficient electric heating systems may be deployed such as resistive heating.

4.5 Hydrogen Boiler Deployment

Hydrogen boilers are considered only from 2035 onwards, reflecting the earliest plausible for hydrogen supply infrastructure and appliance availability. To ensure efficient and coordinated deployment, hydrogen boiler installations are aggregated at postcode level rather than individual building level. The SAP benefit minus cost is calculated for each suitable property, then aggregated by postcode. Postcodes are ranked by their total aggregated benefit. This aggregation prevents geographically dispersed

installations (e.g. isolated properties at opposite ends of the district receiving hydrogen in the same year), reflecting the clustered transition that would happen as sections of the gas network are converted to hydrogen as one.

| 5 Transport

5.1 Private Electric Vehicle Charge Points

Private EV chargepoint (EVCP) projections are based on Winchester's building stock, with household income data sourced from Urban Tide's uZero household dataset and EV car data from CENEX's National EV Insight & Support tool (NEVIS) assessment of Department for Transport (DfT) vehicle registration data. The methodology uses the 2024 EV Car count of 4,774 vehicles from the NEVIS Projections as the baseline for private chargepoint deployment planning, establishing the starting point for year-on-year growth calculations through to 2050.

Properties are assessed for eligibility based on parking space availability, with only properties having at least one parking space considered suitable for chargepoint installation. Eligible properties are prioritised for allocation based on combined household income (highest first) and number of parking space availability, ensuring that higher-income households with greater parking capacity receive installations first. The methodology targets 100% coverage of suitable properties by 2050.

5.2 Public Electric Vehicle Charge Points

Public EVCP projections are based on NEVIS' integration of Department for Transport (DfT) vehicle registration data and Experian vehicle allocation modelling. Registered vehicles indicate where vehicles are formally recorded, while allocated vehicles reflect where vehicles are actually used, correcting for distortions caused by leased or fleet vehicles. The allocated dataset provides a more accurate spatial representation of EV demand across Winchester.

EV uptake follows the Mid projection within NEVIS, which assumes that ZEV Mandate targets are met each year with no borrowing, resulting in a steady, policy-aligned transition toward full electrification by 2035. This forms the basis for estimating Winchester's total EV stock through to 2050.

EVCP requirements are estimated using the blend approach in NEVIS, combining elements of both residential-led charging (with a preference for standard near-home charging) and hub-based charging (with a preference for ultra-rapid chargepoints similar to conventional fuelling stations). This blended strategy reflects Winchester's mixed settlement patterns and diverse charging needs.

Chargepoint projections are driven by EV demand, with chargepoint numbers and socket types linked directly to future vehicle stock rather than fixed ratios. For further methodological detail, refer to the [NEVIS Methodology](#).

| 6 Large-Scale Generation

The Large-Scale Generation methodology identifies suitable locations for large-scale solar and wind energy projects across Winchester and creates a realistic deployment schedule from 2025 to 2050. It begins by analysing land parcels to determine which areas are appropriate for renewable energy development. Suitable parcels for ground-mounted solar PV and large-scale wind are determined by screening national land-parcel datasets against a consistent set of spatial constraints. Parcels are excluded where firm constraints—such as protected habitats, heritage sites, flood risk, transport corridors, steep slopes, built-up areas or high-grade agricultural land—make development unfeasible. Soft constraints, including green belt, open greenspace or proximity to airports, flag locations where development may still be possible but requires further consideration. For each suitable parcel, the system calculates potential energy generation based on land area and technology-specific characteristics.

The approach then considers the electrical grid's capacity to connect new projects. Each parcel is linked to the local electricity network through a hierarchical system of substations, starting with primary substations and escalating to larger ones where necessary. The methodology assesses whether there is sufficient available capacity at each connection point, using a 25% threshold to ensure safe and reliable operation. If no suitable connection exists, the project is flagged as requiring grid upgrades.

Projects are prioritised based on several factors to maximise efficient use of the grid. Those that can connect at lower voltage levels and use less of the available capacity are favoured, as are locations that can only accommodate a single technology type. In this case, the deployment of Ground Mount PV systems is prioritised over onshore wind farm installations. The system then schedules these prioritised projects across the 2025–2050 timeframe, spreading deployments evenly while respecting grid constraints and ensuring a fair distribution of connection capacity among projects.

The methodology produces a prioritised list of projects showing which parcels will be developed, what technology they'll use, where they'll connect to the grid, and how much power they can generate, along with a deployment schedule showing which projects will be built in which years. Projects that cannot be allocated due to insufficient grid capacity are flagged as requiring grid upgrades, helping identify where infrastructure investment is needed to unlock additional renewable energy capacity. This approach ensures that the deployment plan is realistic, cost-effective, and makes the best use of existing grid infrastructure while identifying where strategic investments could unlock additional capacity.

| 7 Storage

The Storage Module estimates the amount of battery storage installed alongside rooftop solar PV (both domestic and non-domestic) and large-scale renewable technologies. The intention is not to produce engineering-grade battery sizing at the individual building level, which would require high-resolution hourly demand and export profiles. Instead, the model applies simple, evidence-based rules of thumb that reflect current UK market practice and realistic adoption patterns. This approach ensures alignment with national evidence sources, including MCS installation data, and distinguishes appropriately between domestic and non-domestic storage behaviour.

For domestic Rooftop PV, typical system sizes in the UK fall within the 3–6 kWp range. UK installer guidance generally recommends around 1.5–2.5 kWh of battery capacity per 1 kWp of PV installed, and the module adopts the midpoint of this range by assigning 2 kWh of battery capacity per 1 kWp of domestic Rooftop PV. Non-domestic PV systems vary more widely in scale, from small 10 kWp systems to several hundred kilowatts. Because commercial buildings often consume more energy during the

daytime, their batteries tend to be smaller relative to their installed PV capacity. To reflect this, non-domestic Rooftop PV installations are paired with 1 kWh of storage per 1 kWp of PV.

Storage uptake remains significantly lower than solar PV uptake nationally. Using MCS installation evidence from Winchester, the module deploys storage based on variable deployment rates depending on the defined scenario. Not every Rooftop PV system receives a battery; instead, the module allocates storage to the 10% of installations with the largest PV capacities in each year. This reflects real-world market behaviour, where larger PV systems are more likely to include batteries to maximise self-consumption and comply with distribution network export-limiting requirements under G99. In contrast, smaller G98 systems - those with export capacities below 3.68 kW per phase - can usually export freely without DNO restrictions, meaning that batteries are optional and often not financially justified.

For large-scale renewables such as ground-mounted solar PV and onshore wind, the model assumes that all new generation developments include co-located battery storage. This reflects current UK deployment trends, where co-location helps mitigate curtailment risk, improves utilisation of the grid connection, and provides short-duration flexibility to the local system. This reflects UK-wide trends noted in the UK Solar Roadmap (DESNZ), which highlight growing use of co-located batteries to reduce curtailment and make better use of constrained grid connections. However, co-location is not universal, and recent Winchester applications show some projects proceed without storage; the modelling therefore represents a strategic, system-aligned assumption rather than a prediction of individual planning outcomes. All generation parcels deployed within a scenario are therefore assigned a co-located lithium-ion battery sized in relation to previously calculated generation capacity. Battery energy capacity in MWh is set to four times the power rating in MW, representing a four-hour duration system. This assumption is consistent with prevailing UK industry practice for utility-scale co-located storage and aligns with the 1–4 hour durations referenced in national LAEP guidance.

| 8 New Build Developments

New build developments are modelled at a fixed annual delivery rate of 1,157 dwellings per year, a figure extracted from the Winchester District Local Plan. This trajectory reflects local housing growth assumptions and is distributed across archetypes (detached, semi-detached, terraced and flats) using observed proportions derived from National House Building Council (NHBC) statistics and recent EPC registration data. Each archetype is defined using representative characteristics consistent with current regulatory standards and local market evidence. Parameters including typical floor area, heat demand, insulation specification and installed heating technology are derived from current and future Building Regulations requirements and observed delivery trends within Winchester over the past five years.

Rooftop PV deployment to new builds reflects both observed local trends and anticipated regulatory changes. For 2025 and 2026, 556 PV systems per year are installed and distributed proportionally across archetypes. This figure is derived from recent MCS installation trends observed within Winchester. From 2027 onwards, all new build dwellings are assumed to include Rooftop PV in line with the expected direction of the Future Homes Standard (FHS). PV system capacity is archetype-dependent and determined using representative roof area assumptions. Larger dwelling types are assigned proportionally larger systems, ensuring internal consistency between building size and installed generation capacity. These range from 4-26 kW depending on archetype.

All new build dwellings are assigned Air Source Heat Pumps (ASHPs). ASHPs are selected as the default technology due to their regulatory alignment, installation flexibility and limited site-specific constraints

compared to alternatives such as Ground Source Heat Pumps (GSHPs), which require land availability assessments not available within this modelling framework. ASHP capacity is archetype-dependent and linked to estimated dwelling heat demand. Heat demand for new builds is assumed at 20 kWh/m²/year, reflecting the performance levels associated with homes designed to meet Committee on Climate Change recommendations as part of a "fabric-first" approach to achieve the UK's net-zero carbon commitments. Resulting ASHP capacities typically fall within the 3–4 kW range depending on archetype floor area. Finally, associated capital costs are assigned using technology-specific cost assumptions aligned with market conditions. This approach ensures that new build deployments reflect realistic build standards and policy-compliant technology choices, while maintaining consistency with the wider modelling framework.

9 Total Energy Demand and Carbon

Energy demand and carbon emissions from heating are first estimated by UPRN the baseline year. The baseline heat estimations match those available in the LENZA platform, in the *Domestic Heat Demand* and *Non-domestic Heat Demand* data sets.

Each UPRN is assigned a baseline heating technology and fuel type from available EPC records. Where these are unavailable, domestic premises are assumed to be electricity-supplied and non-domestic premises are assumed to be gas-supplied, considering full electric central heating or gas boilers as default technologies in each case.

On each year, the following effects are considered at the UPRN level for each retrofit and heating technology installed:

- Insulation reduces on-premise heat demand.
- Heating technologies modify the fuel type and efficiency.
- Rooftop PV offsets electricity demand by the annual generation amount.

On-premise heat demand is translated into effective fuel demand using the efficiency or coefficient of performance (in the case of heat pumps) of the heating technology installed. Yearly fuel demand is calculated for every UPRN as¹:

$$\text{Yearly fuel demand} = \frac{\text{Yearly heat demand}}{COP}$$

The fuel demand of every UPRN is then multiplied by its corresponding emission factor to obtain the yearly emissions:

$$\text{Yearly emissions} = \text{Yearly fuel demand} * \text{Emission factor}$$

Each premise's yearly fuel demand and carbon emissions are compared against the baseline year. The difference between both represent the fuel demand/carbon emissions avoided.

For transport, an average baseline fuel efficiency in kWh/km and emission factor in kgCO₂e/kWh are calculated for the baseline, knowing the initial total fuel demand, total emissions, and vehicle types proportion.

¹ In this expression, the acronym COP is used interchangeably for coefficient of performance (with COP > 1) and efficiency (with COP ≤ 1).

The yearly deployment rate and estimated electricity demand from public and private EV charging points is the same for all scenarios. On a yearly basis, the total kilometres covered by electric vehicles are calculated from the total demand in charging points assuming an efficiency of 0.23 kWh/km for the whole fleet². The baseline fuel demand and emissions are estimated for the same travelled distance, using the baseline average fuel efficiency and emission factor. The difference between both figures represents the fuel demand and emissions avoided each year.

Fuel demand and emissions avoided from existing buildings and transport are aggregated by year. The following are added:

- Total large-scale renewable generation (assumes an emissions reduction due to a reduction in grid electricity imports needed to meet demand)
- Heating demand and PV generation from new builds (considering the heat demand explained in Section 8 and ASHP as the heating technology)

10 Grid Readiness Analysis

Grid Readiness is modelled as yearly Demand and Generation Headroom available at both Primary and BSP level substations. This assessment requires comparison between:

- Projected **peak electricity demand and generation capacity** under the LAEP scenario; and
- Available **network headroom (MVA)** at substations.

As network constraints are defined in terms of apparent power capacity (MVA) at substation level, the appropriate metric for comparison is the peak capacity associated with deployed technologies rather than their annual energy consumption (MWh). However, the effective electrical demand of certain low-carbon technologies (LCTs), particularly heat pumps, depends on performance assumptions such as the coefficient of performance (COP). Consequently, installed asset capacity alone does not fully represent the additional electrical load imposed on the network.

To address this, annual fuel or electricity demand is first derived from the scenario energy outputs for each technology. These annual values are then converted into equivalent peak capacity using technology-specific load factor and performance assumptions. This enables a consistent, like-for-like comparison with available substation headroom expressed in MVA. This assessment is not based on time-series simulation. Instead, it applies a conservative worst-case peak methodology to estimate potential maximum loading or generation and the resulting residual capacity at each substation.

Fuel demand is aggregated annually at Substation level and disaggregated by technology. Technologies were treated separately and their associated fuel demand can't be aggregated together simply, because:

1. Some assets represent demand (heat pumps, EVCPs).
2. Some represent generation (Rooftop PV).

² For reference, see the figures of average electric cars (0.2171 kWh/km) and average electric vans (0.2266 kWh/km) in [Car and van greenhouse gas and kWh calculations · Energy Saving Trust toolkits](#). A value slightly above these two was selected to account for the effect of potentially less efficient vehicles such as buses or freight transport.

3. Different technologies exhibit different peak behaviour (load factors).

Public EV charging capacity is incorporated using indicative charger capacities and distributed across substations where precise locations are unavailable. Grid-scale solar and wind capacity within each substation area is also included, alongside baseline demand and generation headroom figures sourced from SSEN's Network Scenario Headroom Report (2024). Year-0 headroom reflects these published values and the initial year of scenario deployment. Annual changes in electrified demand and generation are aggregated to substation level, incorporating both property-level technologies and public charging assumptions. These projections are then compared with baseline headroom to assess how demand and generation pressures evolve over time and to identify when and where substations are likely to face capacity constraints.

| 11 Decommissioning the Gas Network

The decommissioning analysis estimates the total cost of retiring all Medium Pressure (MP) and Low Pressure (LP) gas pipelines across Winchester. The assessment is undertaken at gas network asset level and focuses exclusively on pipeline infrastructure rather than individual property-level disconnection works.

The methodology begins by scoping the complete MP and LP pipeline inventory within the Winchester boundary. Key asset characteristics including pipeline material, diameter, pressure tier and installation typology are standardised to enable consistent classification. These attributes determine the appropriate decommissioning intervention pathway, recognising that different pipeline types require different technical treatments at end-of-life.

Pipeline segments are assigned to defined intervention categories reflecting the engineering approach required for safe isolation, purging, abandonment and long-term risk mitigation. The categorisation is based on physical asset characteristics rather than demand assumptions, ensuring that the assessment reflects full network retirement.

Costs are estimated using a structured component framework that combines fixed costs associated with job setup, permitting and traffic management requirements, with variable costs driven by the scale of work. A proportional project management and administration allowance is applied to reflect delivery complexity and governance requirements.