SOLENT LOCAL ENTERPRISE PARTNERSHIP LOW CARBON SKILLS REPORT

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WRITTEN BY GEMSERV

Gemserv

South West NET ZERO HUB

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EXECUTIVE SUMMARY

This report provides an evidence-base for the green skills landscape in the Solent region to align with the Solent Local Enterprise Partnership's (LEP) target for the Solent to be a carbon neutral region by 2050. Fundamental to this ambition is having a local low carbon workforce that is large enough and skilled enough to drive forward the transition to net zero. Without enough adequately trained people, low carbon technologies will not be deployed in sufficient numbers to meet the Solent's target for carbon neutrality. Achieving carbon neutrality in the Solent will depend to a large extent on decarbonising several key sectors. This project will provide an in-depth picture of the current green skills landscape and future green skills requirements to help inform decarbonisation efforts across five vital local sectors – retrofit, transport and logistics, hydrogen, green maritime, and marine carbon capture.

The project has taken the form of a skills gap analysis, exploring the labour market implications of the region's transition to net zero. This involved establishing the number of low carbon jobs required in each of the roles to align with the region's ambition for carbon neutrality. We compared these to the skill base regionally, which allowed us to determine the number of jobs required in the sub-sectors and assess the training provision required in the Solent to fill this gap. This study, including the workforce and training requirements, will be used to inform Solent Local Skills Improvement Plan (LSIP).

This report is part of a series of four reports commissioned by the South West Net Zero Hub and two neighbouring Local Enterprise Partnerships the Heart of South West and Solent LEPs addressing green skills in the region. We recommend that this report is read in tandem with its three sister reports: *"South West Net Zero Hub Retrofit Skills Report", "GFirst* Local Enterprise Partnership Low Carbon Skills Report" and "*Heart of the South West Local Enterprise Partnership Low Carbon Skills Report"*.

The Solent LEP region is on the south coast of England and is made up of eight Local Authorities (LAs). The Solent requires a step change in the way that the region has traditionally operated in several key sectors if it is to reach its target to be carbon neutral by 2050. To elucidate this challenge, Gemserv modelled the net zero requirements against four net zero scenarios.

1. **Urgent action:** Assumes a net zero target of 2030.
2. **Balanced approach:** Assumes a net zero target of 2040 (i.e. between 2030 and national 2050 net zero targets).
3. **Gradual approach:** Assumes a net zero target of 2050 in alignment with the UK Government's statutory net zero target.

The key findings in this report are as follows:

KEY FINDINGS

- **At the current rate of deployment of insulation and heat pumps, the Solent is expected to miss its net zero targets.**
    - It would take nearly 1,000 years to install enough ground source heat pumps at the current rate and over 500 years to install enough air source heat pumps.

- At current deployment rates, it will take an over 200 years to install sufficient cavity wall insulation and 141 years for loft insulation.
- Conversely, measures with a more established installer base are on track with enough double glazing being installed in the region by 2045 at the current rate.

- **The Solent requires substantial growth in retrofit jobs and low carbon heating installers to meet to its net zero targets.**
  - An additional 1,557 heat pump engineers are required by 2040 under the Gradual Intervention scenario[1]. Under this scenario, the heat pump engineer labour market will need to grow by 2100% by 2040, meaning that an average of 83 engineers will need to be trained per year.
  - The largest insulation training requirement is for solid wall insulation installers. 655 additional installers are required by 2027 under the Urgent Action scenario and an additional 186 by 2036 under the Gradual Intervention scenario.

- **The Solent needs significant growth in electrical skills to deliver the infrastructure required for low emission transport. Main skills requirements will be in Electric Vehicle (EV) charger installation and grid connection.**
  - To meet its net zero targets, a total of 652,625 EV charge points will need to be installed in the Solent by 2050.
  - To meet these requirements, between now and the peak employment requirement in the mid-2030s, an additional 27 installers will need to be trained each year on average. Collectively, this amounts to providing additional training to 398 installers and 85 maintenance personnel.

- **The Solent requires specialist engineering skills to facilitate hydrogen production and storage deployment in the region.**
  - Many of the projected jobs involved in the Solent's hydrogen sector will command engineering experience or expertise. These skills requirements are likely to be well serviced by the local colleges and universities in the region.
  - The main focus for upskilling will be in CO_2 capture, infrastructure and storage, with upskilling required in front end engineering design (FEED), operations and safety.

- **The Solent's maritime workforce needs to be upskilled to handle alternative, low-carbon fuels as part of the region's transition to green maritime.**
  - In a net zero by 2050 scenario, 375 seafarers will need additional training to operate on ships with alternative fuels by 2030 and 2,108 by 2050. On average, 73 seafarers will need additional training per year.[2]
  - The most important skills needed to facilitate the Solent's transition to green maritime will be in research and development (R&D) and engineering.

[1] Note that all labour requirements are in terms of full time equivalent (FTE)
[2] DNV (2022) Insights into seafarer training and skills needed to support a decarbonized shipping industry

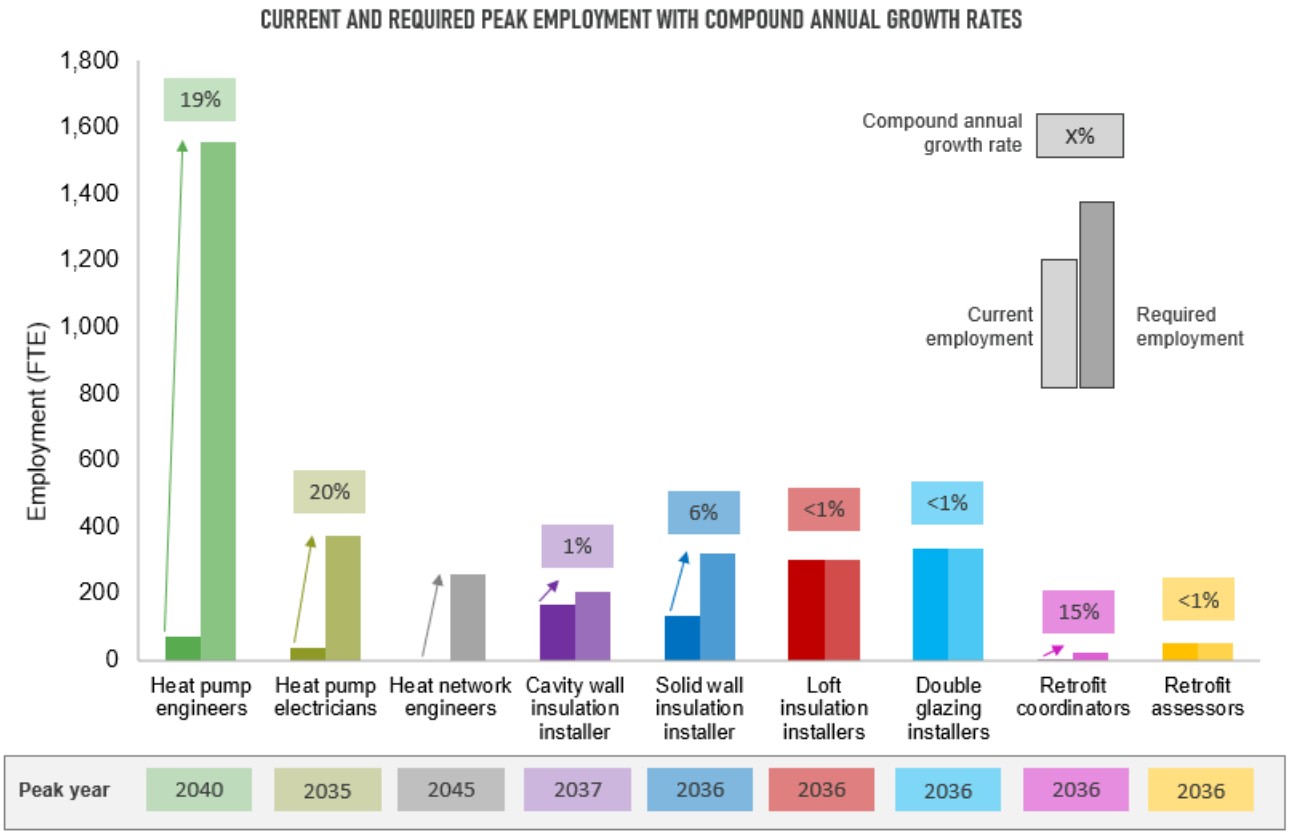

Figure 1 - Current and required peak employment with compound annual growth rates[3]

This report has identified eight recommendations for the Solent LEP to consider in its plans for the region to be carbon neutral by 2050. These are summarised as follows:

RECOMMENDATIONS

1. SUPPORT SECTORS TO JOIN THE DOTS BETWEEN SUPPLY AND DEMAND
    - Play a convening role and support industry to identify potential opportunities for decarbonisation. As an example, the LEP could host workshops or events on hydrogen and hydrogen-based fuels. This should connect hydrogen production, midstream and end use, and could include participants from local industrial firms, businesses involved in converting hydrogen into hydrogen carriers, ports, Southampton Airport, as well as any other potential users.

2. COMMUNICATE EMPLOYMENT OPPORTUNITIES AND SIGNPOST SKILLS REQUIREMENTS
    - Encourage collaboration between industry and education providers to enable future training provision to be tailored to meet industry needs and specific sectoral demand.
    - Engage with STEM fairs to ensure graduates at the universities in the area are aware of the local need for these skills.

[3] Based on peak employment requirement from Gradual Intervention scenario (net zero by 2050). Compound annual growth rate unavailable for heat network engineers due to data suggesting no heat network engineers in the region.

3. CO-ORDINATE INDUSTRY AND EDUCATION PROVIDERS TO DELIVER SKILLS REQUIREMENTS
    - Co-ordinate industrial representatives with similar skills needs in the region. As an example, there is likely to be a high demand for electrical skills in Solent due to electrification of heat and transport, as well as electrical skills being required for electrolytic hydrogen. Identifying cross-sector requirements may support education providers to develop modules to cover core skills, which could be common to different sectors.
    - Develop and grow structured partnerships between industry, education, and training providers at all levels to reflect the requirements of the low carbon sector. This could include:
        - Sector-based work academies that focus on the skills requirements to deliver decarbonisation such as electrical and engineering skills.
        - Supporting re-training of employees, particularly where base skills already exist, and identifying which sectors can easily retrain to low carbon jobs.

4. DEVELOP INFORMATION CAMPAIGNS
    - Produce information campaigns to highlight to school leavers and retraining workers the employment opportunities presented by the shift to low carbon technologies.
    - Work with industry to encourage the development of education packs to be used in primary and secondary school lessons on climate change. These could be sector specific (e.g. low carbon transport) and targeted towards individual year groups.
    - Develop information campaigns targeted towards regional businesses, outlining the support packages available within the region.

5. PROVIDE FUNDING TO SUBSIDISE TRAINING FOR LOW CARBON SKILLS
    - Funding should be provided to support adult training for the most in-demand low carbon skills. This could include fixed amounts of financial support for skills training in sectors identified as having the most significant skills gaps such as:
        - EV charging infrastructure
        - Insulation retrofit
        - Heat pump installation
    - The LEP should encourage and help local employers and training providers to apply for national training funding, via schemes such as the Adult Education Budget and Strategic Development Fund. LAs should apply for national apprenticeship funding on behalf of local schools to improve apprenticeship opportunities for students and school leavers.[4]

6. ADVOCATE FOR ACCELERATED NATIONAL GOVERNMERNT FUNDING AND REGULATION
    - Support Southampton Hydrogen Hub in its application to receive Track-2 funding as part of the cluster sequencing process. This could include advocating for accelerated timeframes for decision making by highlighting the size of the opportunity for hydrogen and hydrogen-based fuels in the area.
    - Advocate for a 'Green Skills Fund' to ensure green skills become an integral and integrated part of training programmes.

7. WORK WITH LOCAL AUTHORITIES TO UTILISE PLANNING POWERS MORE AMBITIOUSLY TO SUPPORT A NET ZERO CONSTRUCTION SKILLS STRATEGY

[4] Department for Communities and Local Government (2017) Apprenticeship reforms: guide for local authorities

- This could include setting higher energy efficiency standards for new developments to minimise the energy efficiency upgrades needed for new housing and to incentivise the development of low carbon construction skills.
- Southampton City Council has already used its devolved powers to set higher energy efficiency standards for new developments.[5] The LEP and other LAs should look to replicate this across the Solent.

8. SUPPORT CROSS-SECTORAL COLLABORATION BETWEEN THE HYDROGEN AND GREEN MARITIME SECTORS
    - Our analysis highlights the likelihood that green maritime in the Solent will be dominated by hydrogen-based fuels. Solent LEP could play a key role in supporting cross sector collaboration through initiatives such as bringing together hydrogen producers with developers of advanced fuels and end users.

[5] Hampshire County Council (2022) Briefing 4: Skills deficits in construction and the policies to address them

INTRODUCTION

The Solent LEP region is on the south coast of England and includes eight LAs, namely, Eastleigh, Fareham, Gosport, Havant, Isle of Wight, New Forest, Portsmouth and Southampton. These are shown in Figure 2 below:

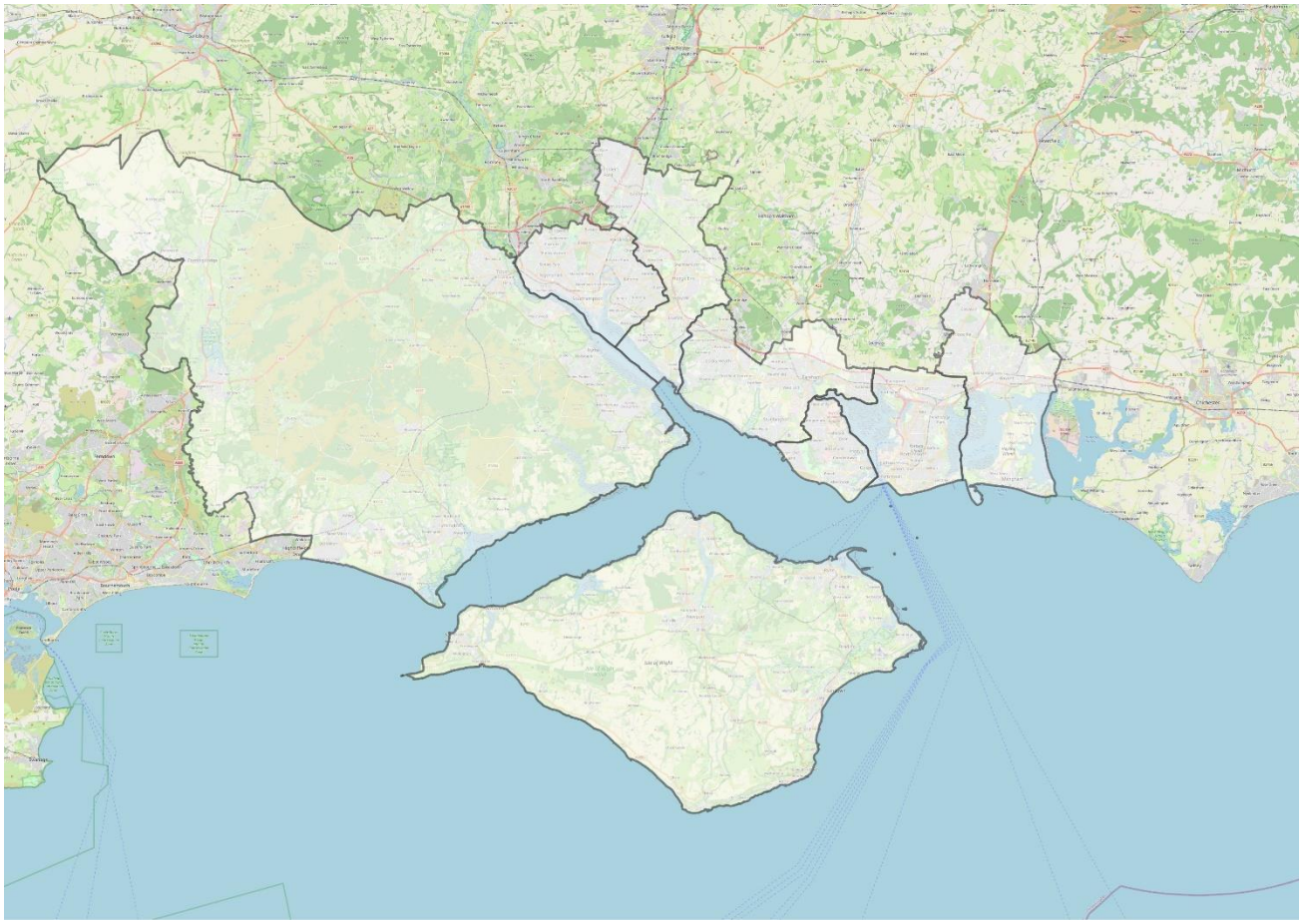

Figure 2 - Local Authorities Within Solent LEP

Like the rest of the UK, Solent LEP has a net zero greenhouse gas emissions target of 2050[6]. However, there are additional regional targets that have been set by the LAs within the area, such as Southampton City Council which is targeting net zero in its buildings and operations by 2030 and in the city as a whole by 2035[7]. For these targets to be achieved, significant changes must be made to how the region produces and uses energy. All sectors of society will face significant changes, including heating, transport, industry and power generation. However, this research focused on the deployment and skills required in five key sectors for the Solent region. The sectors explored are construction, transport and logistics, hydrogen production and storage, green maritime and marine carbon capture.

The project took a two-fold approach to gathering evidence, using both desk-based literature review and stakeholder engagement through focus groups and surveys. The focus groups provided additional insight into the challenges facing hydrogen production and storage, marine carbon capture, and transport and logistics. This report utilises data collected

[6] Solent LEP (2022) Solent 2050 An Economic Strategy for the Solent
[7] Southampton City Council (2023) Southampton City Council Net Zero Strategy Consultation Document

during the wider South West Net Zero Hub (SWNZH) retrofit skills project to understand the opportunities and challenges facing the construction sector.

This study will inform the approach for the area's LSIP, the development of the Solent Cluster for Decarbonisation, future skills in maritime, and the Solent 2050 strategic priorities to develop a world-class talent base and pioneer approaches to climate change adaptation and decarbonisation.[8] It will also inform future investment decisions, to decarbonise the region and make progress towards achieving the regional 2050 net zero target.

[8] Solent Local Enterprise Partnership (2022) Solent 2050 An Economic Strategy for the Solent

EMISSIONS IN THE SOLENT

Territorial net greenhouse gas emissions for end users in the Solent were 4,469 kt CO_{2e} in 2020. This metric reallocates emissions arising due to the processing of fossil fuels and the production of electricity to the final user. As an example, emissions from Fawley Refinery are not included in this metric, as the refinery emissions would be counted where the fuels are burnt rather than the refinery location[9]. Figure 3 below shows the emissions broken down by LA and sector. Land Use, Land-Use Change and Forestry (LULUCF), shown as orange on the graph below, can be a removal of greenhouse gas emissions which reduces the net emissions figure for a region.

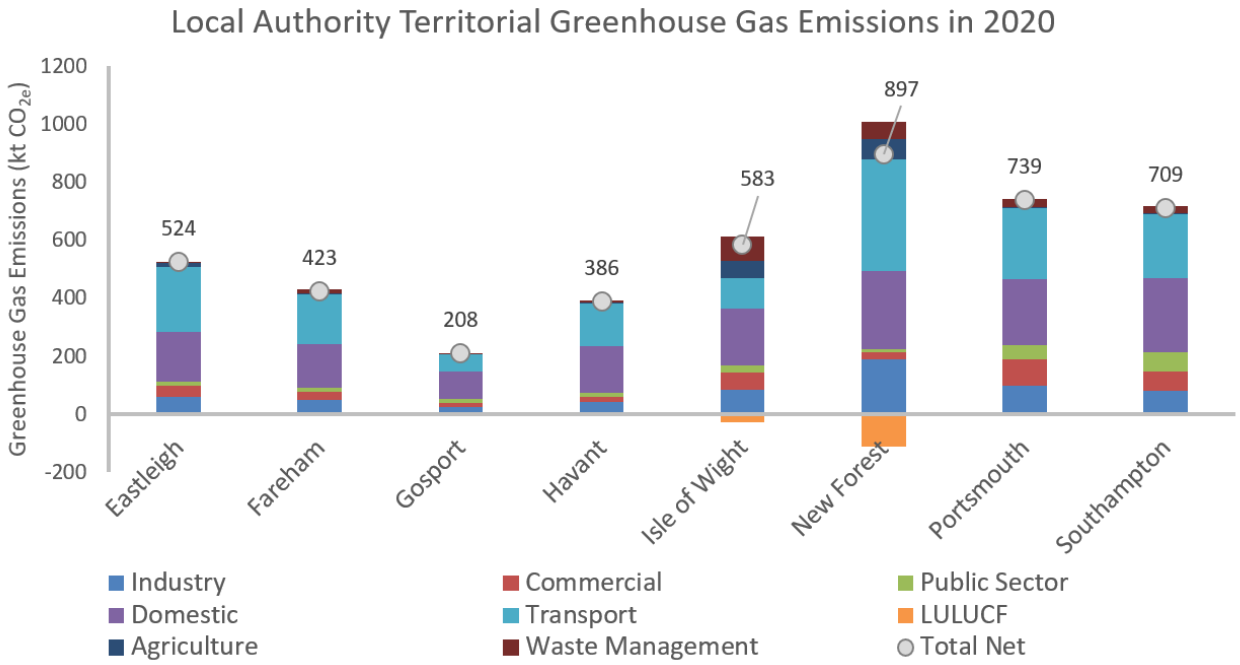

Figure 3 - Emissions in Solent shown by source and local authority[9]

Figure 3 shows that the three largest sectors for emissions in Solent LEP are domestic, transport and industry, highlighting the need for action in these areas. The options for reducing emissions from these sectors are explored in more detail in this report in the retrofit, transport and logistics and hydrogen sections.

In addition to these emissions, the region must decarbonise Fawley Refinery, which was responsible for 2,866 kt CO_{2e} in 2020. It is expected that emissions from Fawley Refinery will reduce as demand for hydrocarbon-based fuels falls. However, this demand could be partially replaced by growth in sustainable aviation fuels (SAF) and biofuels. Additionally, there are opportunities for refineries to move into other areas such as chemicals production which will be required in a net zero society[10]. Refineries can be decarbonised with a combination of electrification, fuel switching to hydrogen, carbon capture of process emissions and decarbonisation of hydrogen supply.

[9] BEIS (2020) UK local authority and regional greenhouse gas emissions national statistics
[10] Johnson Matthey (2022) Transition to net zero: steps to decarbonize the oil refining industry

POLICY CONTEXT

NATIONAL POLICY

According to the Clean Growth Strategy, the low carbon sector could grow 11% per year between 2015 and 2030, four times faster than the projected growth of the economy as a whole[11]. It could also deliver between £60 billion and £170 billion of export sales of goods and services by 2030. Analysis by the Institute for Public Policy Research (IPPR) has found that a full retrofitting programme in England could sustain over 400,000 direct jobs and 500,000 indirect jobs by 2030, and up to 2.7 million jobs in total as the programme is ramped up further in the run-up to 2050.[12] The UK has set a legally binding net zero target for 2050 which will bring unrivalled opportunities for economic growth and job creation. However, without urgent action to train and upskill workers at scale in the green industries of the future, regions will miss out on the immense growth opportunities offered by the Green Industrial Revolution.

The UK was one of the first countries to announce a clear phase out date for the sale of fossil fuel vehicles. The sale of new petrol or diesel cars will be banned from 2030. This announcement has prompted significant investment in low carbon transport, with virtually all major car companies now investing in EV manufacture.

Chris Skidmore MP's long-awaited "Review of Net Zero" was published in January 2023[13]. The review was originally commissioned to ensure that the UK's transition to net zero does not place an undue burden on consumers and businesses. The final report provided a thorough assessment of the UK's current progress towards net zero and set out the future actions necessary for the country to deliver on its climate goals. A list of the review's recommendations that have relevance to the scope of this report can be found in the Annex.

NATIONAL SKILLS POLICY

Since 2018, Skills Advisory Panels (SAPs) have been bringing together employers, skills providers and other key stakeholders to address skills shortages at a local level. SAPs are supported by grant funding from the Department for Education (DfE) primarily to produce high-quality analyses of local labour markets and to publish Local Skills Reports.

The Skills for Jobs White Paper, published in January 2021, set out several reforms to post-16 technical education and training to ensure that new entrants to the workforce have the skills that employers require. The White Paper produced the following recommendations:

- Align technical education and training to employer-led standards set by the Institute for Apprenticeships and Technical Education, so that skills provision meets skills needs.
- Continue to improve and grow apprenticeships, so more employers and individuals can benefit from them as part of the Lifetime Skills Guarantee.
- Use the £2.5 billion National Skills Fund to enhance funding to support adults to upskill and reskill.
- Establish the Strategic Development Fund to offer funding to help colleges respond to locally agreed priorities. Local institutions and organisations, such as LEPs and SAPs can use the funding to address local skills challenges

[11] BEIS (2018) Clean Growth Strategy
[12] IPPR (2023) GREENGO UNLOCKING AN ENERGY EFFICIENCY AND CLEAN HEAT REVOLUTION
[13] BEIS (2023) Net Zero Review: UK could do more to reap economic benefits of green growth

or to invest in local priority sectors. Funding will be targeted towards local colleges and other training providers, who will use it to improve the local skills landscape. This could be by investing in new or upgraded facilities and equipment, setting up a College Business Centre, or pump-priming new provision in growth areas. [14]

As part of the Lifetime Skills Guarantee, the DfE is investing in employer-led skills bootcamps. These are short, flexible training courses lasting 12- 16 weeks which will help adult learners retrain or learn new specialist skills.[14] Skills bootcamps can also be used to help regions meet critical skills needs in certain sectors. In the Solent region, there are currently green skills bootcamps for Green Level 3 Heat Pumps, run by Eastleigh College, and an online course for EV charging installers and domestic electrical installers, run by Trade Skills 4 U.[15]

LOCAL POLICY

The LEP has already set ambitious local decarbonisation goals, promising to transition the Solent to a net zero carbon economy before the national target of 2050. Eastleigh Borough Council have gone even further by pledging to make their council activities carbon neutral by 2025, and support businesses and communities to be net zero by 2030[16]. In its long-term economic strategy for the Solent, entitled *Solent 2050*, the LEP identified taking pioneering approaches to climate change adaptation and decarbonisation as one of its key strategic priorities for the region[17]. These bold decarbonisation targets, coupled with its strong local specialisms, make the Solent well placed to be one of the key regions driving forward the UK's Green Industrial Revolution. This is reinforced by Hampshire being mentioned as one of the net zero hotspots by the Climate Intelligence Unit with 4.2% of GVA coming from the net zero economy and creating almost 19,000 net zero jobs.[18]

Yet, whilst ambitious targets are key in driving action, these targets cannot be delivered upon without a motivated workforce, equipped with the skills required to tackle climate change. Workforce productivity is 1.5% lower in the Solent than the average for Great Britain as a whole, and nearly 7% behind the average for the South East. Local skills have been identified as a key contributing factor to the region's low productivity[17]. The current skills and productivity landscape in the region is a major obstacle to the Solent meeting its decarbonisation goals and fulfilling its wider economic potential.

However, the Solent has some of the levers at its disposal to tackle the skills challenge head-on. The region has three world-class universities, which provide local businesses with a pool of highly skilled graduate labour and bring research expertise that will help the Solent develop with pioneering approaches to decarbonisation. The Solent's universities alone generate an estimated £4.2 billion GVA to the UK and support around 52,300 jobs[17]

The presence of several top universities and research establishments gives the Solent a unique opportunity to become a global leader in green technology. The transition to net zero will necessitate the development of new low-carbon technologies and solutions to mitigate and adapt to climate change. Research and development (R&D) is something that the Solent excels at, with the region ranking 10th out of all LEPs nationally for the percentage of its workforce in R&D related professions. By channelling the region's considerable R&D resources towards strategically important

[14] DfE (2021) Skills for jobs: lifelong learning for opportunity and growth
[15] DfE (2023) Find a Skills Bootcamp
[16] Eastleigh Borough Council (2019) Climate and Environment Emergency Strategy
[17] Solent LEP (2022) Solent 2050 An Economic Strategy for the Solent
[18] Energy and Climate Intelligence Unit (2023) MAPPING THE NET ZERO ECONOMY

sectors such as green maritime and hydrogen production, the Solent could become a world-leading hub of high-tech, low carbon innovation.

According to forecasts produced by the Construction Industry Training Board (CITB) on the estimated recruitment requirement for low-energy construction occupations across Portsmouth, Southampton and the Isle Wight, only 8% of those jobs required a degree, with the rest requiring NVQs or other technical qualifications. While it is important to recognise that the landscape will be different in other less labour-intensive sectors, the research does highlight the reality that many of the green skills touched upon in this report will be learnt not at universities, but at technical colleges and employer-led training centres. There are already several further education colleges and training providers in the region offering a range of vocational courses in green skills. However, it will be necessary to expand and enhance the region's non-university further education offering so that the Solent has the vocational green skills needed to complement its strong pre-existing track record of producing high-skilled university graduates. A diverse mix of skillsets are required so that the Solent workforce is ready to meet the structural changes in employment that will accompany the region's transition to net zero

Established in April 2019, Solent SAP has been instrumental in identifying local skills needs and using this intelligence to shape the provision of post-16 education and training in the region.[19] As part of their Skills for Jobs White Paper, the DfE are currently trialling LSIPs in eight areas of the country, with the intention to roll them out more widely, including in the Solent. These aim to engage more closely with employers to put their insights and needs at the heart of future local skills strategies.

There are numerous local skills initiatives in place in the Solent, many of which include a green skills component, as seen in Table 1 below.

Table 1 - Skills initiatives in the Solent region

Initiative	Details	Aim(s)
Solent Building Back Greener Loan Fund	The £5m Fund offers loan funding of between £100,000 and £1m for capital projects. The zero-interest loan will provide up to 50% of the total project costs. Projects must start on site by June 2022 and complete by March 2024. Projects must contribute to one or more of the following areas: • Green growth in the Solent maritime sector that aligns with the Clean Maritime Plan • The Solent economy's pathway to Net Zero • The green skills and training that Solent employers need[20]	To help accelerate the commercialisation of low-carbon technology, innovations, and systems. To position the Solent as a hub of green innovation.
Sustainable Business Support Programme	6-month programme started in late 2022. The programme allocates a sustainability advisor to help businesses build a Sustainability Action Plan. It includes a combination of 1:1 and group support sessions. Support will cover a number of different areas, such as:	To support businesses to adopt more sustainable practices and adapt to the net zero transition.

[19] Solent LEP (2022) Local Skills Report
[20] Solent LEP (2021) Solent LEP Annual Report (eastleigh.gov.uk)

	• The climate crisis and how it impacts businesses • How to create an effective sustainability strategy • Ways to calculate your carbon emissions and set data-driven goals[21]	
Solent Careers and Skills Hub	The LEP has developed an online Skills Portal. Its launch was supported by a marketing campaign in 2022 offering careers and skills advice.[22]	To showcase and signpost the range of skills development opportunities available across the Solent.
Enterprise Adviser Network	The LEP is working in partnership with the Careers and Enterprise Company to deliver the Enterprise Adviser Network. This will match Solent business leaders with local schools and colleges.[23]	To strengthen the link between education and industry. To connect students with role models from business who can give them real-life careers advice. To encourage new entrants into key sectors, such as green maritime.
Fareham College DfE Strategic Development Fund pilot	Fareham Colleges is leading a £1.9 million pilot funded by the Strategic Development Fund. The pilot will see 11 Further Education and Sixth Form Colleges in the Solent region work collaboratively on a range of upskilling projects in the region.[24] Projects include providing the skills needed for a future green economy and for jobs related to carbon reduction.	To ensure that new entrants and the existing workforce are equipped with the right skills for the future economy. To prepare the workforce for the structural changes brought about by the Green Industrial Revolution.

These local initiatives are a promising start and represent the proactive approach of the LEP and local councils towards the green skills shortage. Nevertheless, more concerted action is needed to both map out and identity local green skills gaps, and then to devise effective strategies to address them.

[21] Shaping Portsmouth (2022) Solent LEP helps local businesses take first steps towards sustainability - Shaping Portsmouth
[22] Solent LEP (2022) Local Skills Report
[23] Solent LEP (2022) Solent 2050
[24] Solent LEP (2022) Local Skills Report

SECTOR BASED SKILLS ASSESSMENT

This section outlines the current sector specific context of the low-carbon themes in question, the current skills and training provision including likely jobs, and the skills and training gaps within the Solent LEP region. The sectors in scope of this report are retrofit and low carbon heating, transport and logistics, hydrogen production and storage, green maritime and marine carbon capture.

It should be noted that all labour requirements have been detailed in terms of full time equivalent (FTE). With the current maturity of the markets discussed, it is likely that people will work across multiple trades and therefore full-time equivalent figures are anticipated to be lower than the total stock of people possessing the skill. For example, many heat pump installers will spend time installing both heat pumps and fossil fuel boilers. However, as markets mature and demand grows, it makes more economic sense for labour to specialise in a particular technology or skill. This means that future training requirement projections are likely to be largely similar in terms of FTE and total labour.

RETROFIT

RETROFIT POLICY

The Heat and Buildings Strategy sets out how the UK will decarbonise domestic and non-domestic buildings as part of the pathway to reach net zero by 2050.[25] The UK's building stock contributes to around a quarter of UK emissions. There are a range of policies already in place to address emissions from buildings. These help to support the decarbonisation of buildings by incentivising the uptake of energy efficiency measures. The Government has also set several ambitious targets focused on energy efficiency and retrofit:

- To reduce UK heat demand by 15% by 2030[26].
- To install 600,000 heat pumps per year from 2028.
- To retrofit all homes to EPC Band C or higher by 2035.

The policies outlined in the Heat and Buildings Strategy are projected to support 240,000 'green' jobs by 2035. This will bring enormous demand for retrofit skills on a national scale.[27]

The Government is committing a substantial amount of funding towards retrofit and energy efficiency. They have allocated £6.6 billion over the course of this Parliament (2019-2024) to energy efficiency and a further £6 billion for 2025 to 2028 was announced in the Autumn Statement, which represents a doubling of the Government's current annual investment in energy efficiency.[28] This funding is being delivered through several key national funding schemes, as shown in Figure 4 below.

[25] HM Government (2021) Heat and Buildings Strategy
[26] HM Treasury (2022) AUTUMN STATEMENT 2022
[27] HM Government (2021) Heat and Buildings Strategy
[28] HM Treasury (2022) AUTUMN STATEMENT 2022

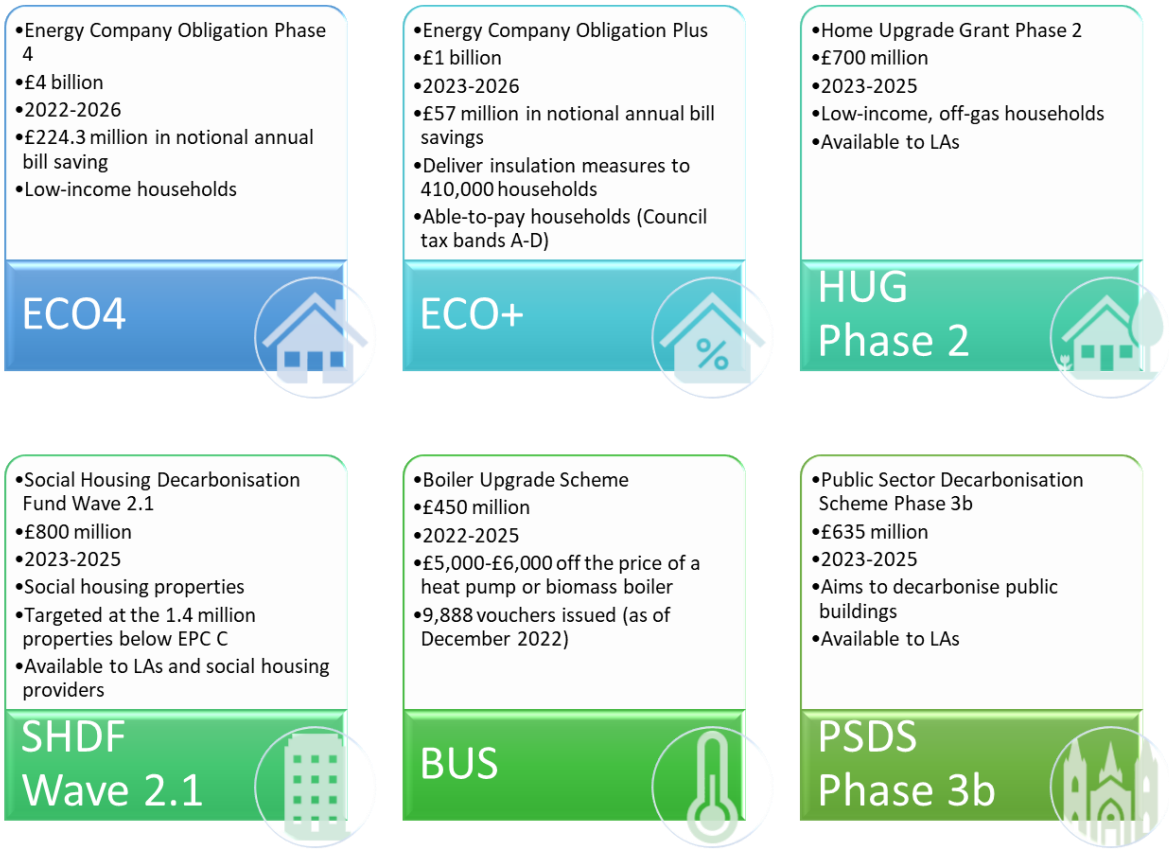

Figure 4 - Summary of government retrofit funding schemes[29 30 31 32 33 34]

All of the above national energy efficiency and retrofit programmes are available to Solent residents, dependent on their household meeting the eligibility criteria. Some of these funding streams – HUG, SHDF and PSDS – can be accessed directly by LAs. LAs can also encourage local uptake of other funding streams like ECO4, by playing a crucial role in identifying and referring eligible households. Funding has already been committed to these schemes up until 2025. The Chancellor's announcement of further energy efficiency funding from 2025 to 2028 means it is likely that these schemes will continue to operate in a similar way for the foreseeable future, possibly with increased funding commitments.

However, the rate of retrofitted energy efficiency measures will need to be increased drastically across all regions of the UK, including the Solent, if local and national net zero targets are to be met. One of the main barriers preventing the Solent from delivering the volume of retrofits required to meet its energy efficiency, low carbon heating and net zero targets, is a shortage of retrofit skills. There are numerous funding policies and funding schemes to incentivise the uptake of energy efficiency measures and low carbon heating systems, but there are far fewer policies focused on training new entrants and the existing workforce in the retrofit skills needed to decarbonise the housing stock at pace and scale.

[29] BEIS (2022) Help to Heat
[30] BEIS (2022) Energy Company Obligation, ECO+: 2023-2026
[31] BEIS (2022) Energy Company Obligation, ECO4: 2022-2026, Government Response
[32] Energy Savings Trust (2023) What is the Boiler Upgrade Scheme? - Energy Saving Trust
[33] BEIS (2022) Boiler_Upgrade_Scheme__BUS__Statistics_December_2022.xlsx (live.com)
[34] BEIS (2022) Public Sector Decarbonisation Scheme: Phase 3

INTRODUCTION TO THE BUILDING STOCK IN THE SOLENT

To understand the size of the challenge in decarbonising the building stock for the Solent region, a thorough analysis of EPC data across the region was carried out to estimate the potential range of low carbon measures as well as the key characteristics of the dwelling stock. The EPC analysis was carried out on an adjusted sample of data. This was to help to account for properties without an EPC record whilst avoiding any potential distortion this may have had on the data.

Overall, the share of the building stock of the region with EPC certificates is roughly equally divided between on-grid and off-grid properties. The coverage of EPC records in terms of the proportion of properties that have an EPC varies based on building characteristics. Coverage for off grid properties is slightly lower at 67% compared to that of on grid properties (68%), and overall coverage is marginally lower than the wider SWNZH region. The proportion of properties with an EPC for each local authority can be seen in the Annex. As properties are required to have a valid EPC when constructed or marketed for sale or rent, properties with an EPC record, by default, tend to be newer and better insulated than those without. To account for this selection bias, a stratified sample was formed by duplicating records of select properties to match the breakdown of properties detailed in data on all properties in the area. By matching the number of properties by size, access to the gas grid and age, a representative sample of the entire building stock in the area was formed accounting for any selection bias through targeted stratification.

Age of properties

The age of properties is an important influencing factor when determining the requirement for energy efficiency measures and low carbon heating. Generally, older properties tend to be more poorly insulated and often are more difficult to insulate such as those with solid walls. The age breakdown of properties in the Solent region (Figure 5) is more modern than that of the wider region and the rest of the UK. **Only 6.4% of domestic properties in Solent were constructed before 1900**, less than half the average for England, 15%.

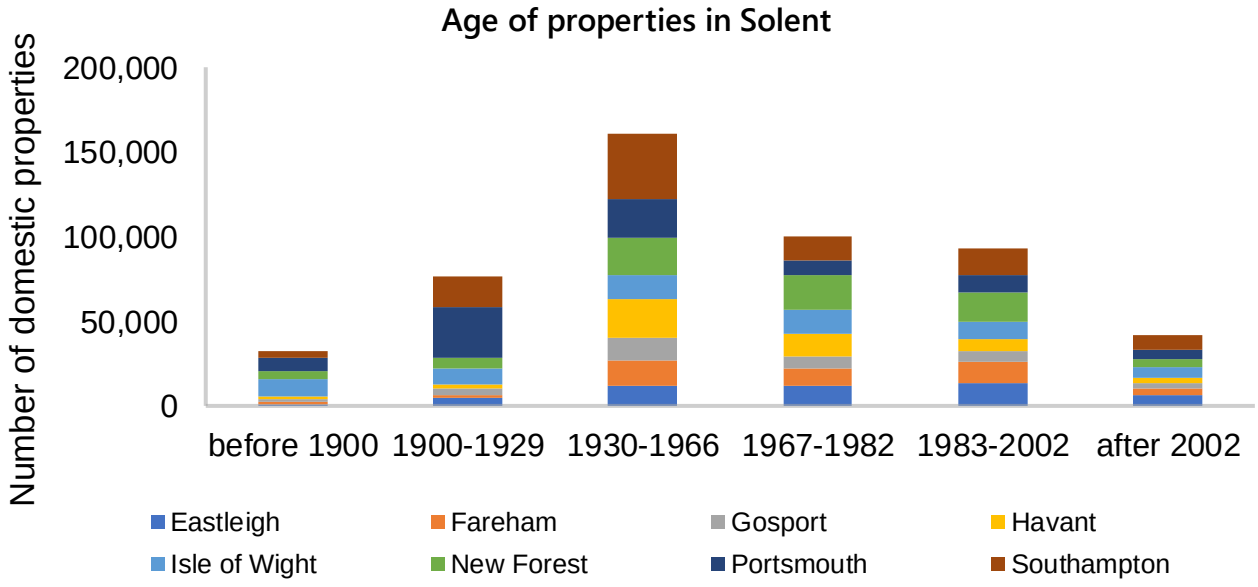

Figure 5 - Age of Building Stock in Solent

Property Type

The property type will influence the relative feasibility of different ways of decarbonising buildings. Property type will influence the route that buildings will take to decarbonising. A property's suitability for certain heating systems for example may be influenced by its size and position. This may determine whether installing certain measures in a property is technically and economically feasible. The Solent is more urban than some surrounding areas and hence has a higher share of flats at 28% compared to the SWNZH area as a whole, 22%. Flats often lack the space required to install standalone heat pump systems. Therefore, flats may be more suited to heat network systems, potentially using a ground source heat pump with a shared ground loop. Nearly half of all properties in Southampton are flats and less than 10% are detached houses, potentially resulting in a more restricted choice of low carbon heating systems. A breakdown of property type is shown in Figure 6.

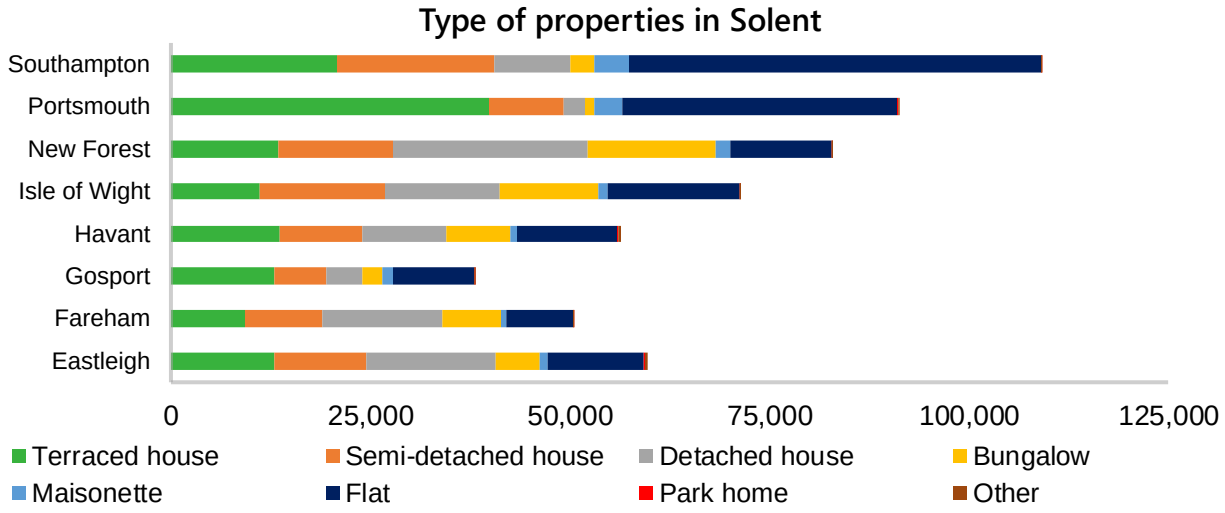

Figure 6 - Property type by Local Authorities in Solent

EPC ratings

EPC Ratings offer an important insight into the energy efficiency levels of properties, ranging from A, high energy efficiency, to G, low energy efficiency. Areas with a high proportion of properties with lower EPC ratings are likely to be suitable for major retrofit programmes, where insulation measures can lower the energy consumption of the property significantly. 42% of domestic properties in the region have EPC ratings of A-C, roughly in line with the average in England of 43%[35]. The most common EPC rating is D, encompassing around 40% of properties. As shown in Figure 7, the lowest share of well insulated properties is on the Isle of Wight and in New Forest, with only 38% of properties having an EPC rating of A-C. Eastleigh has a significantly higher share of well insulated properties with over half of the domestic building stock having EPC ratings of A-C and only 11% properties having a lower EPC rating than D.

[35] ONS (2022) Energy efficiency of Housing, England and Wales, country and region

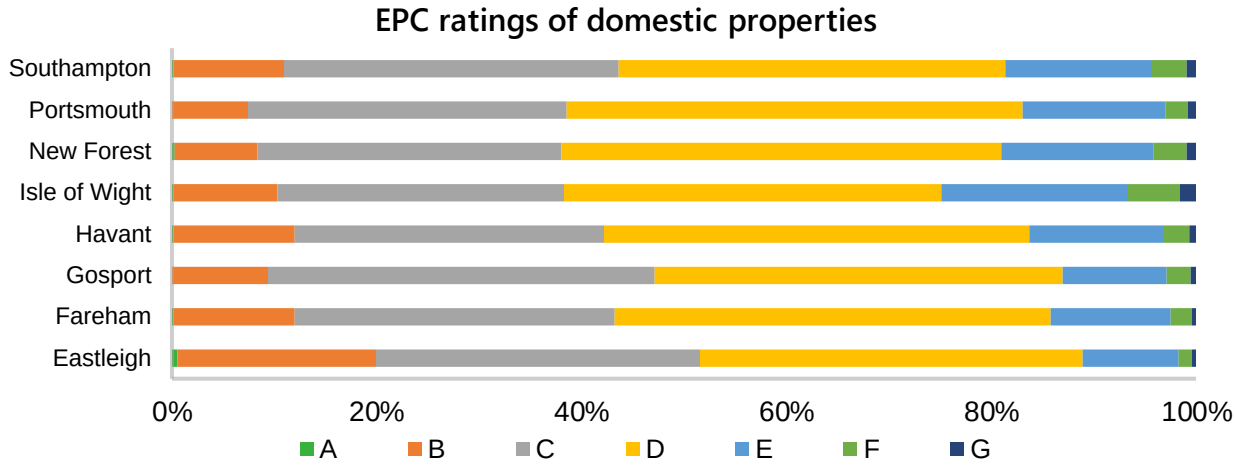

Figure 7 - EPC ratings of domestic properties by Local Authority

Access to the gas grid

Despite being home to multiple urban areas, the Solent has a higher share of properties not on the gas grid, 19%, than the national average, 15%[36]. Access to the gas grid widens the range of potential low carbon heating options available to homeowners with the potential for hydrogen boilers, especially in the context of the ambition to produce hydrogen in the region. Generally, as off grid properties have historically been restricted to using direct electric heating or fossil fuel systems that use LPG or oil, heating emissions and bills typically have been higher in off-grid properties. Due to this, uptake of low carbon heating systems such as heat pumps have been higher in off grid areas. For example, around 460 heat pumps were installed in the New Forest last year compared to just 46 in Southampton.

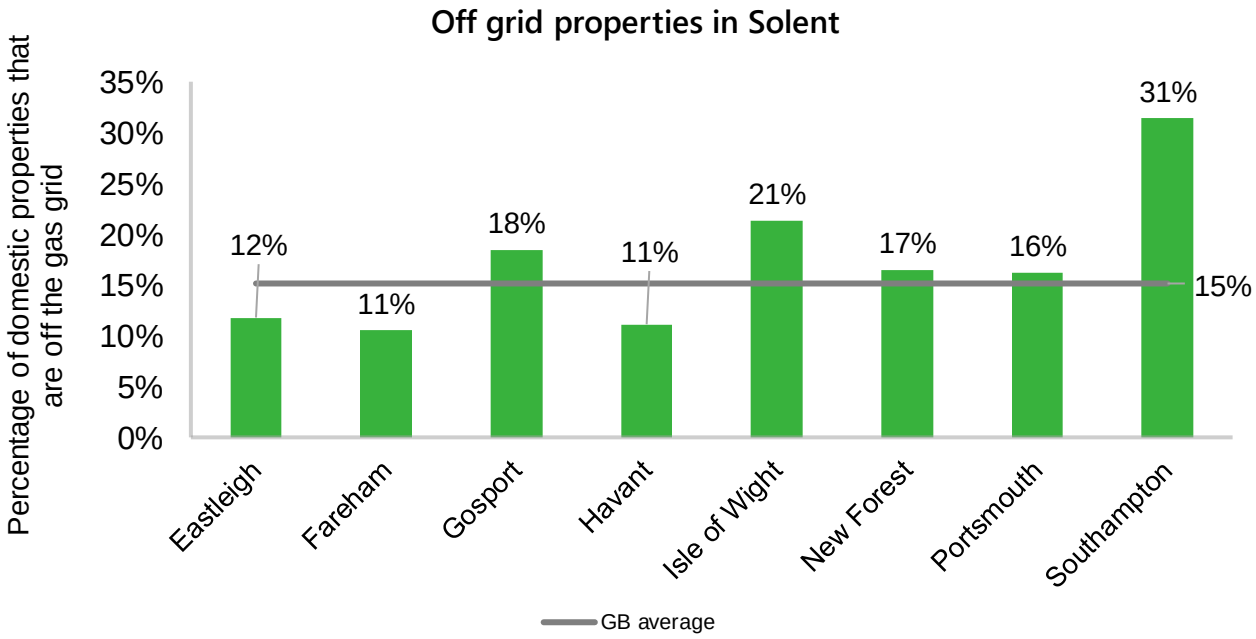

Figure 8 - Percentage of off-grid properties by Local Authority

[36] BEIS (2022) Sub-national estimates of properties not connected to the gas network

Wall type

Older homes often have solid walls as opposed to cavity walls. This makes these homes harder to insulate, requiring external or internal solid wall insulation, which is highly labour intensive to install and can come at a high cost to the consumer. Due to this, historically, solid walled properties have tended to be insulated at a lower rate than cavity walled properties and thus, a large share of solid walled properties require retrofitting. For the Solent however, this issue is less present than the rest of the UK due to the relatively new building stock. Only 15% of properties in the Solent have solid walls, less than half of the UK average, 33%[37]. This will make the overall time to insulate the walls of properties in the Solent lower than in surrounding regions, potentially freeing up labour to install other measures such as double glazing or cavity wall insulation.

Figure 9 - Percentage of properties with solid walls by Local authority

Primary heating systems

Around 37% of UK emissions are from heating buildings, so changing the way we heat our homes, offices and shops is vital in reducing emissions[38]. The rollout of low-carbon heating measures is therefore one of the primary ways that a significant proportion of domestic emissions can be reduced and to do this, a skilled installer base, capable of installing, maintaining, and replacing low-carbon heating measures will be needed.

The Solent has a far higher share of properties with access to the gas grid than surrounding LEP areas. Most properties not connected to the gas grid use electrical heating systems, likely in flats in urban areas. It is evident that heat pump uptake has been more prominent in off-grid areas with five times as many heat pumps in off-grid properties compared to on-grid properties despite only 18.5% of properties being off the gas grid. Properties with access to the gas grid predominantly use natural gas fuelled heating systems, leaving the potential to switch to hydrogen boiler systems if conversion of the gas grid to hydrogen takes place.

[37] HM Government (2015) SOLID WALL INSULATION Unlocking Demand and Driving Up Standards
[38] Catapult (not dated) A Guide to Decarbonisation of Heat

This analysis predominantly revolves around the need to install heat pumps at scale. Hydrogen boilers were not included as their role in the future heating mix is largely uncertain due to:

1) Government not taking a decision on whether hydrogen will be used for domestic heating until 2026[39].
2) Hydrogen boilers being dependent on the rollout of hydrogen distribution networks.

Despite this, it is worth noting that the outputs of our analysis would be largely different under a scenario with a high penetration of hydrogen heating. As hydrogen boilers work via the combustion of gas, similarly to conventional natural gas boilers, the challenge of upskilling labour is simpler than with heat pumps. It is predicted that a hydrogen boiler conversion course would take less than half a day, compared to up to 5 days for a comprehensive heat pump training course[40].

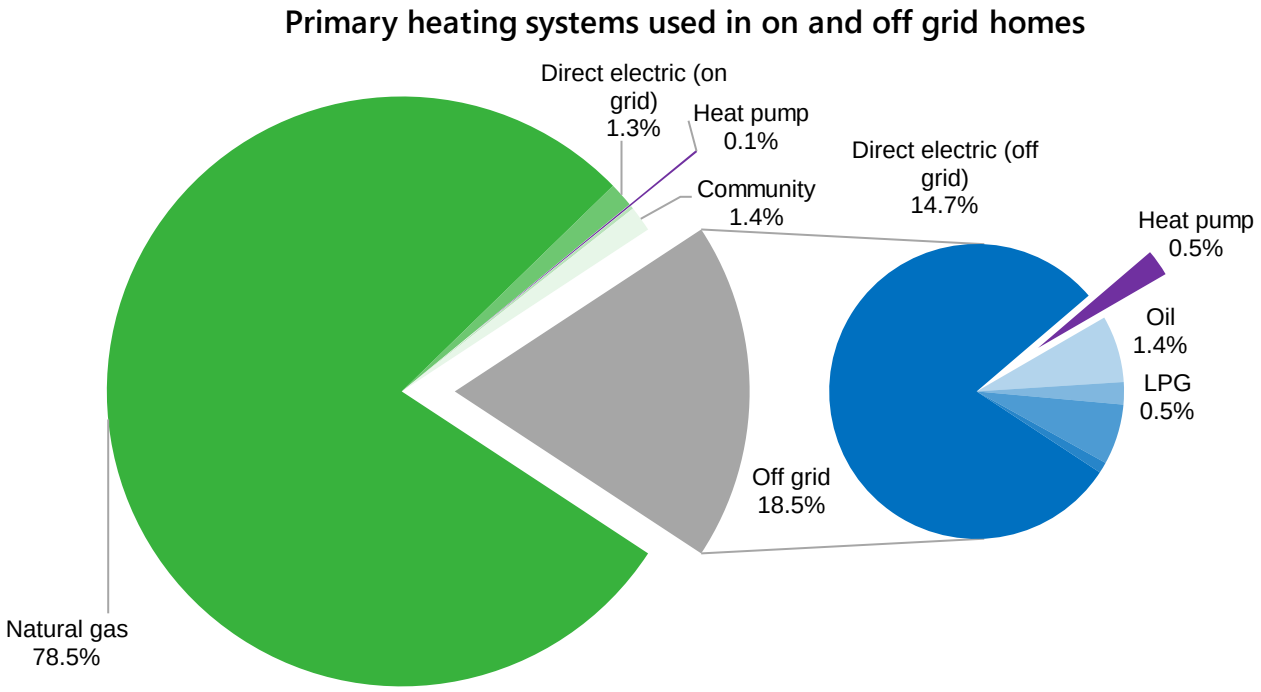

Figure 10 - Primary heating systems used in on and off grid homes

CURRENT RETROFIT DEPLOYMENT IN THE SOLENT

An estimated 24% of Hampshire's greenhouse gas (GHG) emissions come from domestic properties, so significant local action is required to meet the Solent's net zero ambitions. Fuel poverty is concentrated in the urban south of the county (Portsmouth 10.8%, Southampton 10.4%) and the Isle of Wight (11.4%).[41] Addressing fuel poverty and the need to reduce carbon emissions will require increased capacity to be developed in the Solent's existing retrofit supply chain to deliver the level of local retrofits needed.

[39] BEIS (2021) UK Hydrogen Strategy
[40] IGEM (2023) The Future of Home Heating
[41] Hampshire County Council (2021) A Green Economic Recovery for Hampshire

The deployment rate of insulation measures in the Solent is slightly higher than the rest of the UK, however it is not sufficient to decarbonise the building stock before 2050. Despite the low share of solid walled properties, the low deployment rate of solid wall insulation, 104 installs per year, will need to be addressed to achieve net zero.

The take up of low carbon heating measures has been lower in the Solent region in comparison to surrounding areas, this is potentially due to the lower share of rural homes. Less than 1,000 heat pumps were installed in the region last year, with Havant, Portsmouth and Southampton failing to adopt heat pumps at scale. Less than 150 heat pump installations were completed across the three LA areas. More rural areas such as New Forest have higher take-up with 428 air source heat pumps and 29 ground source heat pumps estimated to have been installed in the LA area last year.

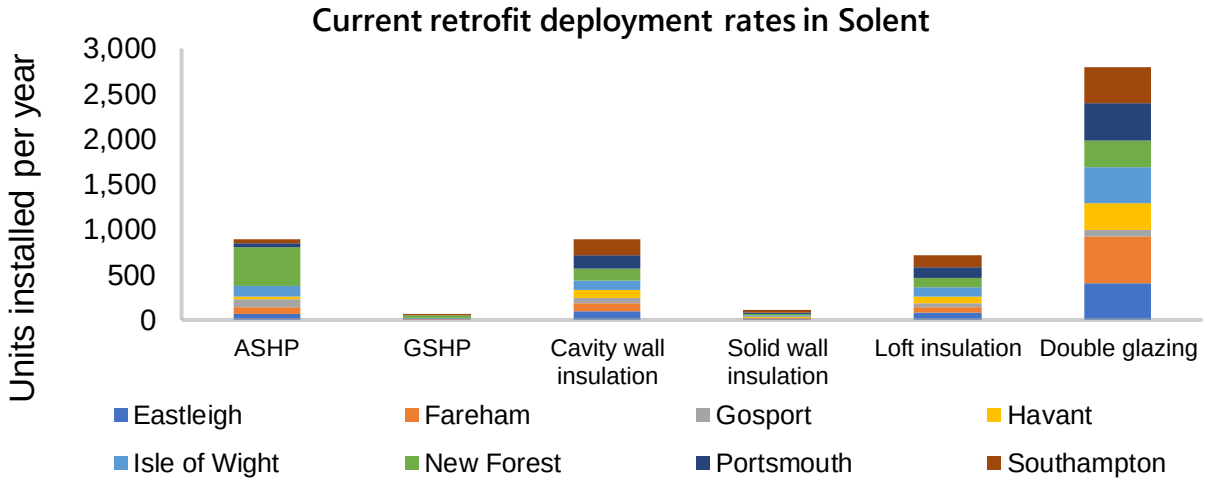

Figure 11 - Annual retrofit deployment by measure and Local Authority

An analysis of the deployment rate of accredited low carbon heating systems shows that the Solent is falling behind the rest of the UK. Per 1,000 households, just 4 accredited low carbon heating installations have been made in the Solent, just over half the UK average of 7. The Isle of Wight and New Forest are the only local authority areas with deployment rates greater than the UK average with 12 and 8 installations respectively per 1,000 households. This is in line with previous findings showing that take-up of low carbon heating has been greater in rural areas.

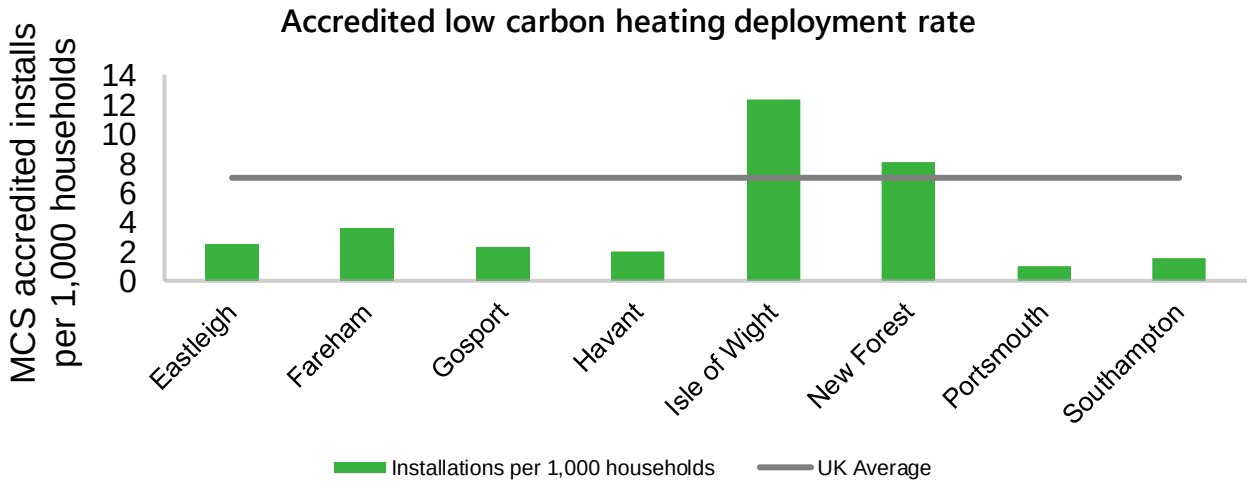

Figure 12 - Accredited low carbon heating deployment rate[42]

[42] MCS (not dated) Data Dashboard

There are a number of programmes available to support retrofit deployment. The Sustainable Warmth competition for the 2022-23 financial year is expected to invest around £500 million to help LAs to upgrade energy inefficient homes of low-income households in England.[43] Through this competition, LAs can bid for a combination of HUG and LAD3 (Local Authority Delivery Phase 3), which are two separate fuel poverty schemes aimed at on gas grid and off gas grid properties respectively. A consortium of 21 LAs led by Portsmouth City Council was successful in securing almost £32 million of funding via the Sustainable Warmth competition.**Error! Bookmark not defined.** This grant funding is available in all Solent LAs, except for the Isle of Wight. Low-income, owner occupied and private rental residents in these areas are entitled to a grant to fund the installation of numerous energy efficiency measures, ranging from insulation and double glazing to solar panels and heat pumps.[44]

CURRENT RETROFIT AND LOW CARBON HEATING BUSINESSES AND LABOUR AVAILABILITY

Through a study of a range of employment data and accreditation schemes, a detailed view of the current retrofit labour market was formed. The graphs below show the number of businesses in the region by retrofit services offered and the labour density of retrofit installers, assessors, and coordinators. Across the Solent an estimated 990 people work across the construction and servicing of energy efficiency measures. The most common services provided by businesses were double glazing (20 businesses) and retrofit assessment (33 businesses). Although retrofit assessment is the most common service offered by businesses, the size of retrofit assessor businesses is generally smaller than retrofit installation companies. Retrofit assessors tend to be sole traders and so in terms of total employment, the most common skill is double glazing installer (334 FTE) and not retrofit assessor (90 FTE). Across the Solent**, 80 people work in the insulation sector for every 100,000 people** although this figure is higher some regions such as Fareham, at 198.

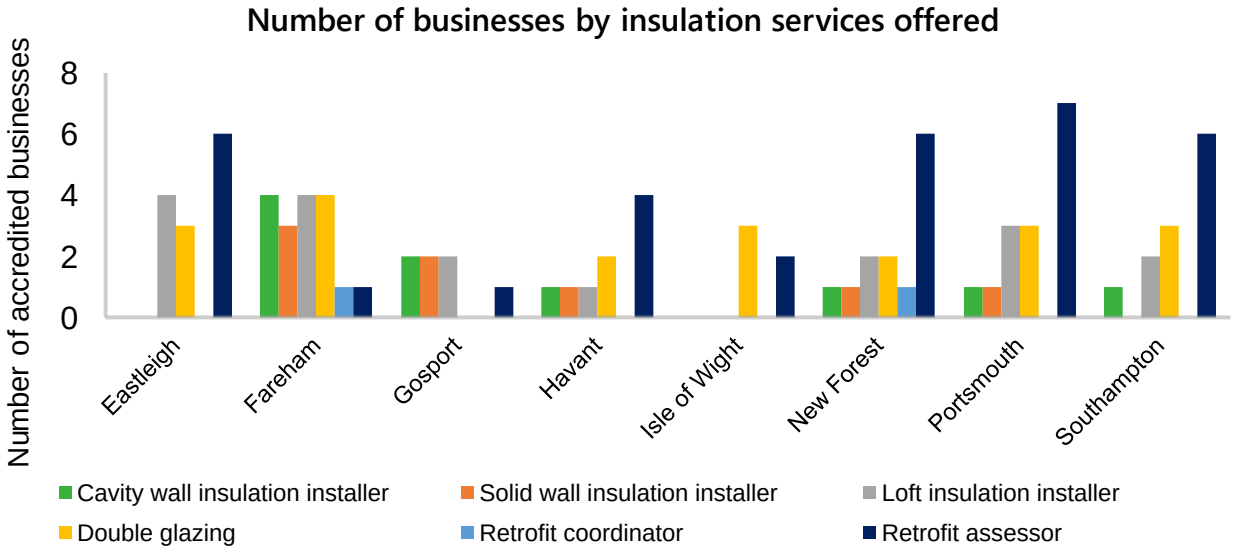

Figure 13 - Number of businesses by insulation services offered and Local Authority

[43] BEIS (2022) Sustainable Warmth Competition: successful local authorities
[44] Switched on Portsmouth (2023) Warmer Homes Programme

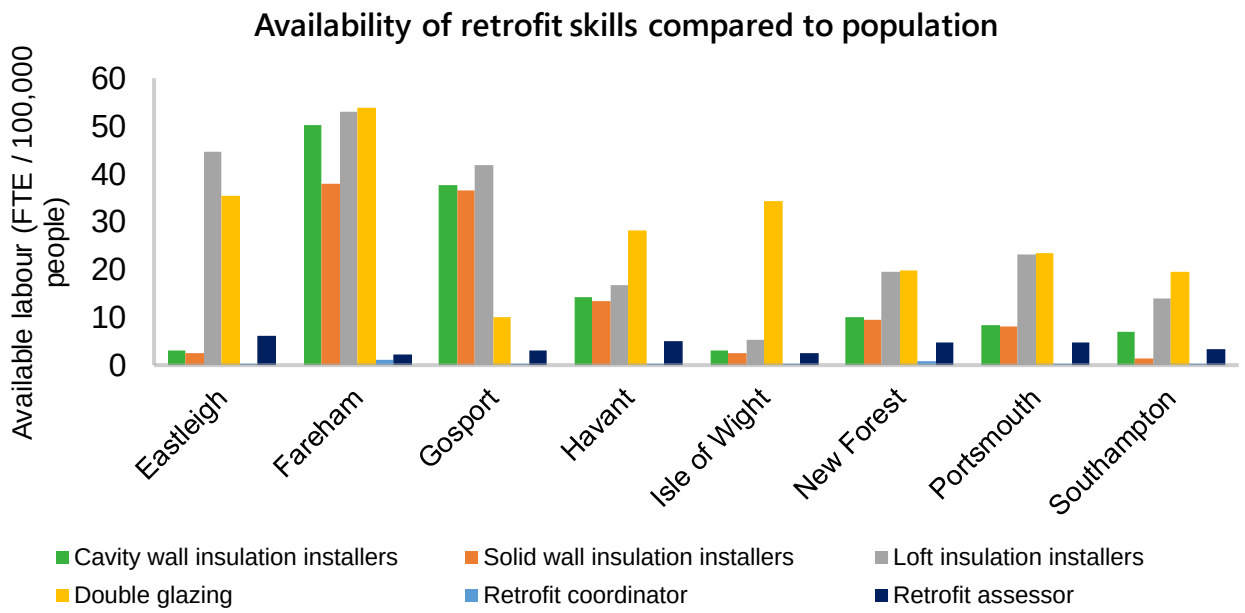

Figure 14 - Availability of retrofit skills compared to population by Local Authority

Despite the low deployment rate of low carbon heating measures in the region, the Solent has a relatively high current provision of labour in the field. There are 35 MCS accredited companies offering heat pump installation services in the Solent, with 12 of these offering both air and ground source heat pumps and the remaining offering only air source heat pump installations. Unlike surrounding regions, our estimates show that of the 105 people actively working in the deployment of renewable heat, all work in accredited heat pump installation companies. This is contrary to other evidence from BEIS which suggests that only 17% of companies offering heat pump installation services are MCS accredited, although this difference may be due to selection bias in the BEIS survey sample or inactivity amongst respondents[45]. Across the Solent, an estimated 9 people work in the installation of heat pumps per 100,000 inhabitants. The highest concentration of heat pump installers is in Eastleigh where there are 18 heat pump installers per 100,000 people.

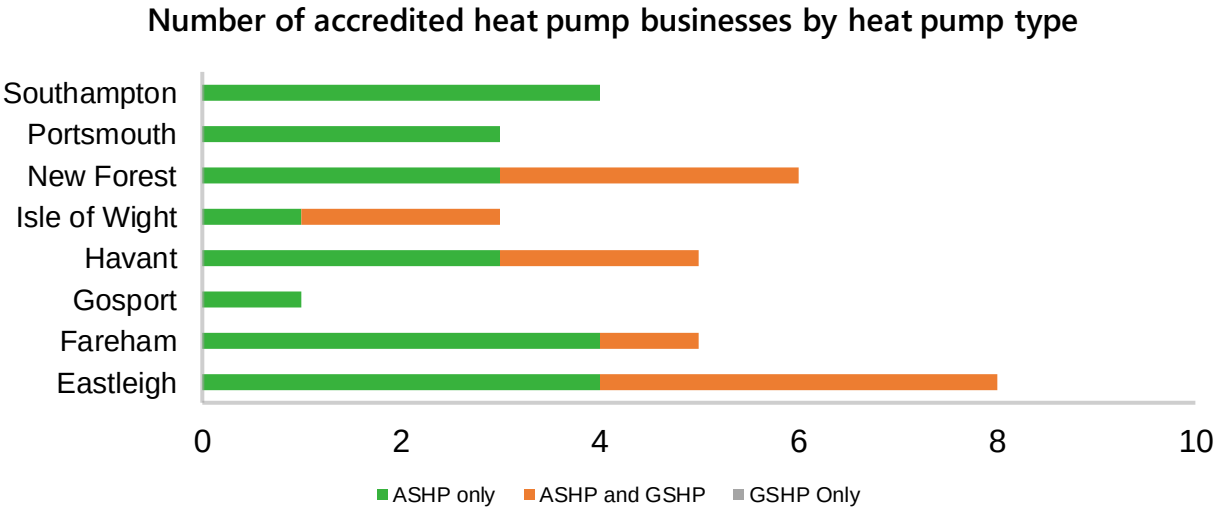

Figure 15 - Number of accredited heat pump businesses by heat pump type

[45] BEIS (2022) Heating and Cooling Installer Survey

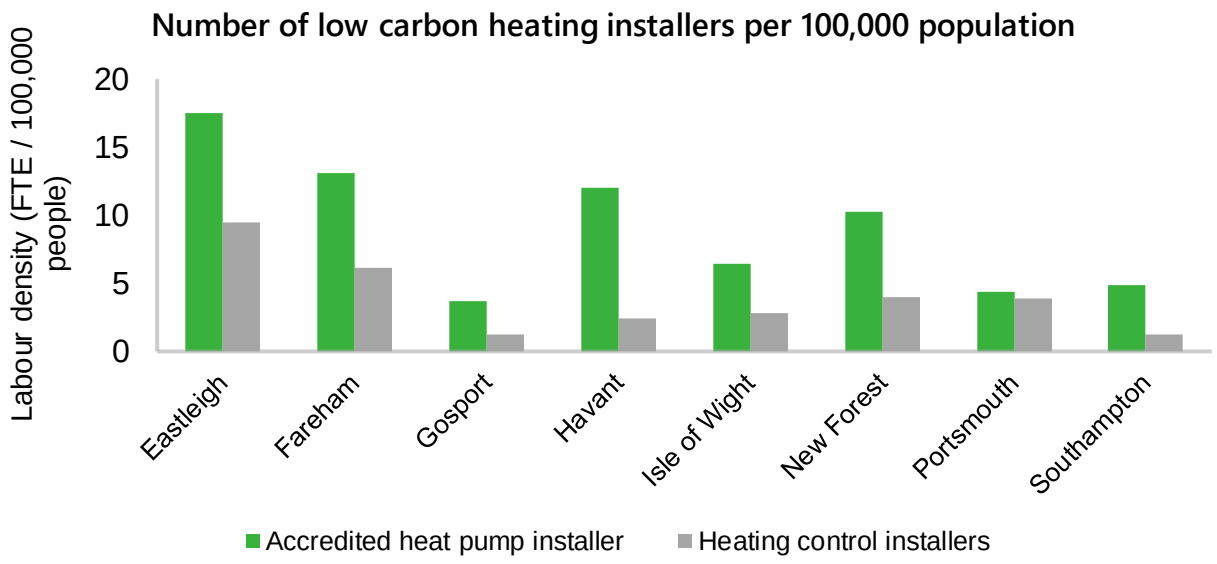

Figure 16 - Number of low carbon heating installers per 100,000 population

QUANTIFYING THE RETROFIT CHALLENGE FOR THE SOLENT

By studying the building stock in the region, the number of retrofit installations required to decarbonise the dwelling stock was quantified. The most common retrofit installation requirement by far is for air source heat pumps with nearly **470,000 required** across the region and over 70,000 in each of New Forest, Portsmouth, and Southampton respectively. The most common required insulation measure is cavity wall insulation, with **190,000 required** across the region.

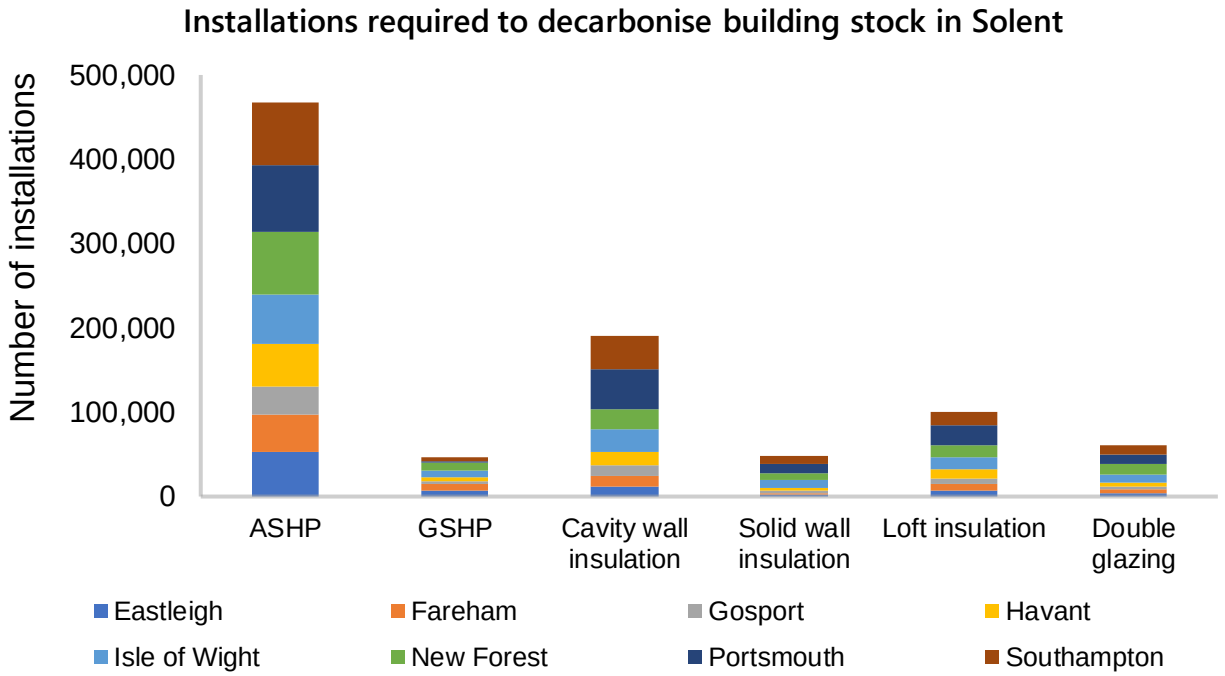

Figure 17 - Retrofit measures required to decarbonise the building stock by Local Authority

Across both domestic and non-domestic properties, a deployment rate far greater than the current one will be required to realise net zero by 2050[46]. Between domestic and non-domestic properties, the forecasted measures are largely similar. However, owing to the larger average size of non-domestic properties compared to domestic properties, the requirement for ground source heat pumps tends to be higher per property. Domestic properties, especially those in urban areas, are more suitable to heat networks. An estimated 360 heat network connections will need to be installed per year in Southampton if they are to decarbonise the domestic building stock by 2050[47]. Our analysis suggests that the need for insulation measures such as double glazing and cavity wall insulation is greater in non-domestic buildings suggesting that these properties have lower energy efficiency levels than the domestic property stock.

The low deployment rates and high requirement for low carbon measures in the region means that net zero targets are set to be missed without significant action to support a higher installation rate. It would take nearly 1,000 years to install enough ground source heat pumps at the current rate and over 500 years to install enough air source heat pumps. Conversely, measures with a more established installer base are on track, with enough double glazing being installed in the region by 2045 at the current rate.

[46] Domestic and non-domestic required installations and installation rates can be found in Annex X
[47] Heat network deployment taken from WPD (2022) Distribution Future Energy Scenarios and relies on assumptions around population density using data from ONS (2022) Population profiles for local authorities in England

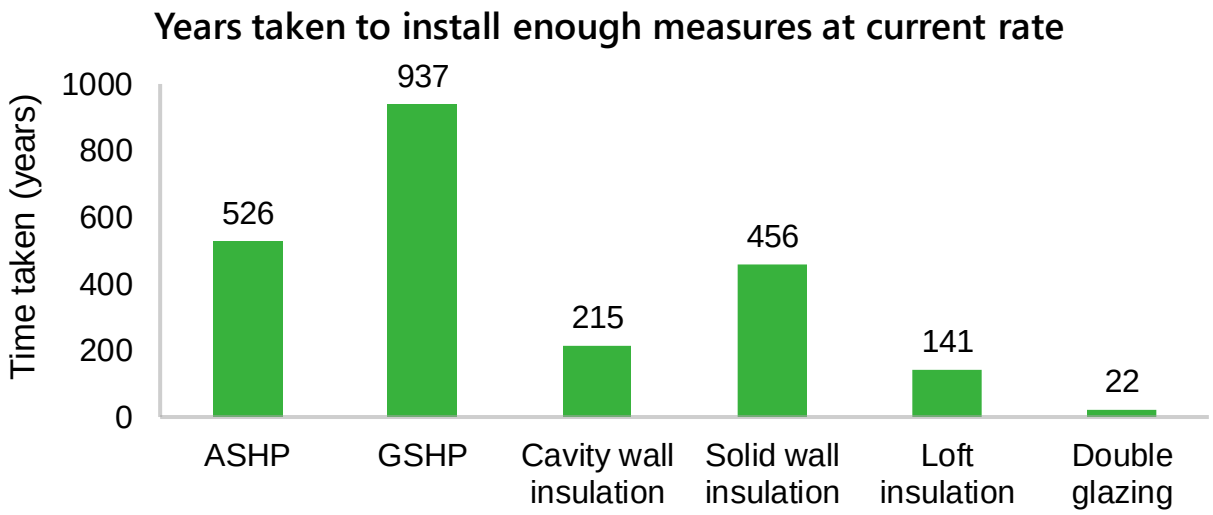

Figure 18 - Years taken to decarbonise building stock at current rates

INTRODUCTION TO THE SCENARIOS

Gemserv have developed four decarbonisation scenarios to show the potential routes to decarbonising the building stock in the Solent region and the resulting skills requirement. It should be noted that the charts provided in this section are illustrative and that exact deployment curves will be influenced by local requirements and current skills provisions.

The development of the scenarios was underpinned by four criteria:

- **Localised –** Recognising the net zero targets and requirements of individual LEPs while considering local strengths, weaknesses and potential blockers.
- **Optimal –** Provide a route to net zero that is optimal in terms of cost, employment, and carbon.
- **Comparable –** Scenarios should allow for comparison between scenarios as well as with UK wide scenarios and targets.
- **Achievable –** To varying extents, targets were designed to be achievable with the correct intervention and also display the different relative ease at which different scenarios can be realised.

In general, the projected deployment follows an "S" curve. This allows time for the workforce, and hence the deployment rate, to ramp up and peak around half way between the start and end date. This shape results in a skills "bell" curve, which minimises potentially distortionary effects on the labour market and reduces the risk of over- or under-training. Literature suggests that a skills bell curve is optimal[48], however some measure of skills surplus is largely unavoidable, especially with highly ambitious targets. The degree to which there will be surplus will vary between scenarios and technologies, with some technologies requiring a greater element of long-term operation and maintenance. The evidence displayed in Figure 18 shows that in a "business as usual" scenario, net zero targets will be

[48] ESC (2022) Domestic Retrofit: Market Intelligence & Skills Assessment

missed. All of the produced scenarios are net zero compliant and so will require some level of intervention to reach the higher deployment levels required.

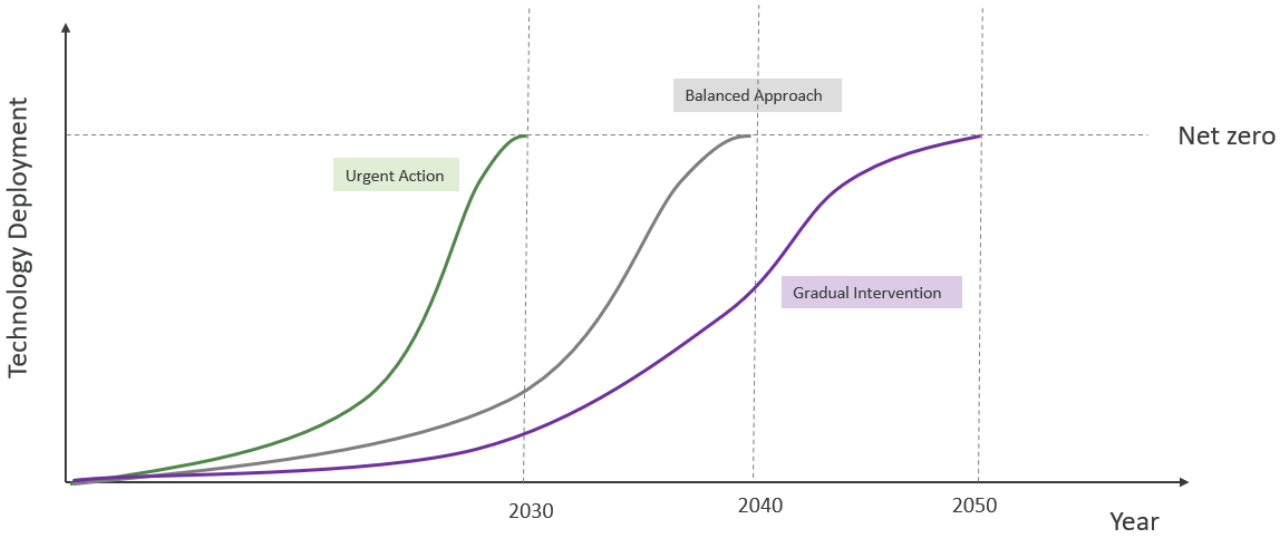

Figure 19 - Measure deployment curves for Scenarios

Scenario 1 – Urgent Action

The Urgent Action scenario shows the required deployment and labour needed to hit ambitious local net zero targets, reducing emissions quickly. Most local authorities in the region have less ambitious targets however Eastleigh has 2030 as their net zero target. This is the most ambitious scenario and will require urgent action across both low carbon heating and retrofit to be realised. The effect of the difference in urgency of action on the economy and skills can thus be compared across scenarios.

Scenario 2 – Balanced Approach

The Balanced Approach scenario reaches net zero by 2040, demonstrating the achievability of a pre-2050 net zero target. For many local authorities, reaching net zero by 2030 will be largely unachievable considering the current provision of skills and technology.

Scenario 3 – Gradual Intervention

The Gradual Intervention is line with Solent's 2050 net zero target and consistent with the UK's legally binding target. This scenario allows for comparisons with UK wide projections and gives a benchmark for the achievability and practicality of more ambitious targets.

Please note, for the purposes of this report, we have chosen to include only the graphs for the Gradual Intervention scenario as it most closely ties into the region's net zero targets. However, graphs for the other scenarios can be seen in the annex.

REQUIRED GROWTH IN ENERGY EFFICIENCY MEASURES TO REACH NET ZERO

Rapid growth in the deployment of insulation measures is required to reach net zero in the Solent, as shown by Figure 20[49]. This is especially seen in the Urgent Action scenario where 91,758 individual measures are installed in 2028 across the region, retrofitting nearly 60,000 properties with energy efficiency measures. Under the Gradual Intervention scenario, the peak deployment rate is 34,000 individual measures in 2034 with 15,000 of these being cavity wall insulation installs. To achieve net zero by 2050 in line with the Gradual Intervention scenario, an average yearly installation rate of 6,000 cavity wall insulation installations, 1,800 solid wall insulation installations, 3,400 loft insulation installations and 2,200 double glazing installations must be achieved.

Across all measures, a swift ramp up of deployment rates will be required, especially under the Urgent Action and Balanced Approach scenarios. The most required measure across the scenarios was cavity wall insulation with 242,000 installations, followed by loft insulation with 153,000 installations and double glazing with 113,000 installations. Due to the modern housing stock and low share of solid walled properties in the region, it is projected that up to 47,000 solid wall insulation installations may be required in the Solent. It is important to note that the requirement for solid wall insulation is far lower than in surrounding areas. Installing all these measures would result in 277,000 homes being retrofitted with energy efficiency measures, with 63,000 of these being in Portsmouth. It is anticipated that the deployment of insulation measures will be relatively geographically dispersed, however nearly a half of the cavity wall insulation installs are expected to be within Portsmouth and Southampton.

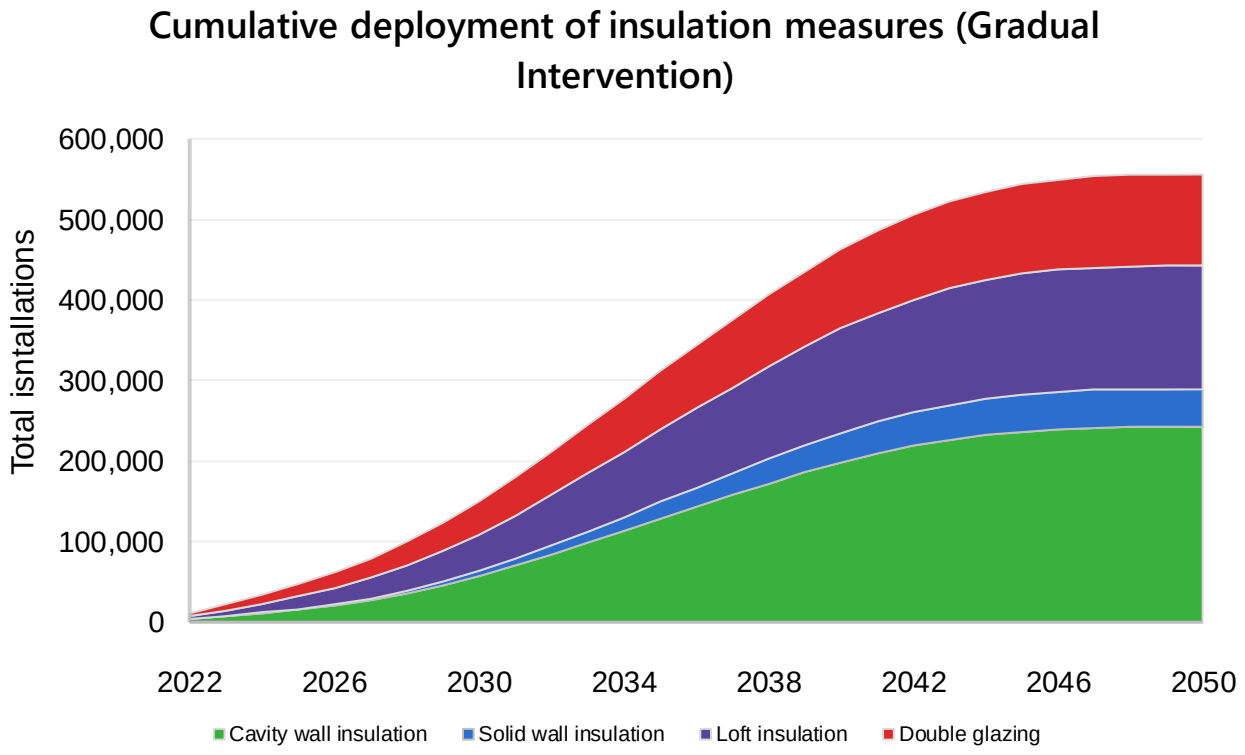

Figure 20 - Cumulative deployment of insulation measures (Gradual Intervention)[50]

[49] Retrofit and new build installations included.
[50] Remaining scenarios can be found in annex 4

Insulation payback times

Homes that require insulation measures that combine to give the lowest payback time could be prioritised to lower bills and emissions at the greatest rate. Often low-cost measures such as loft insulation can yield large savings resulting in a low payback time. In a Gemserv simulation of this approach to retrofit it was found that under the Gradual Intervention scenario, the average payback time of retrofit measures in 2023 was 5 years, a third of the payback time of measures in 2045. In the Solent there are an estimated 75,000 domestic properties which can be insulated with a payback time less than 5 years[51].

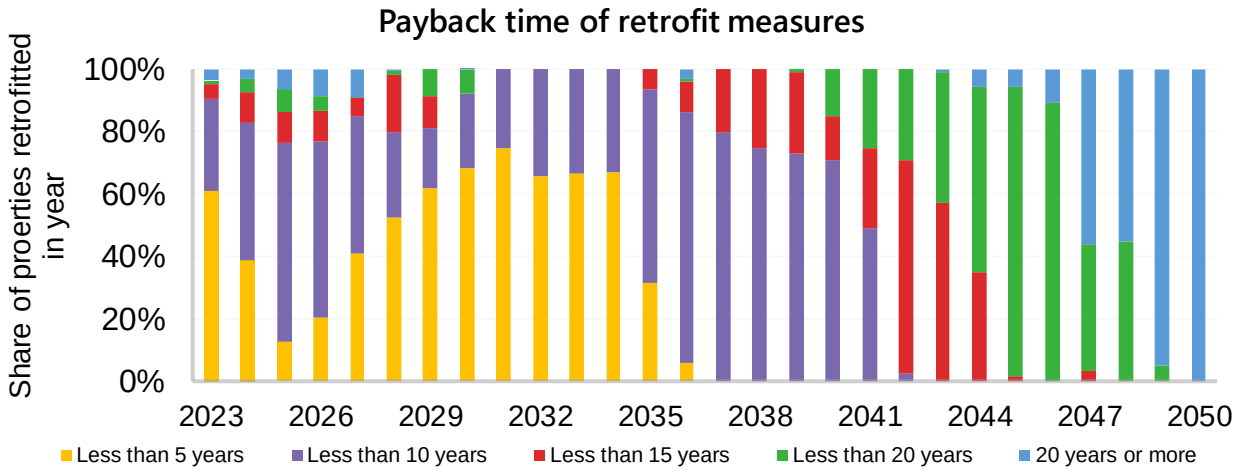

Figure 21 - Payback times of retrofit measures[52]

If the scenarios were to operate on the basis of prioritising properties with the lowest payback times and utilising the current workforce, short term bill reductions and carbon savings could be maximised. Across all scenarios, **£174 million could be reduced from annual domestic consumer fuel bills** across the region once all required insulation measures are installed. Moreover, by prioritising lower payback time measures and maximising the capacity of current labour in the region, an estimated £49 million could be reduced from consumer bills in the first year under the Urgent Action scenario[53].

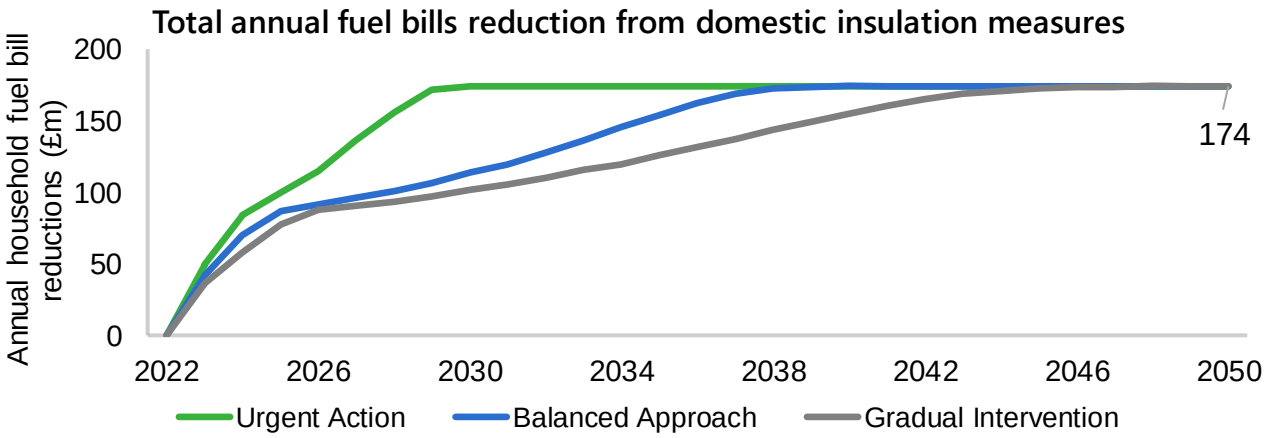

Figure 22 - Total annual fuel bills reduction from domestic insulation measures

[51] Simulation is separate to projections displayed in figure 20 and is for demonstration of potential of selective retrofit approach.
[52] Based on internal Gemserv modelling and simulation of low payback time home prioritisation approach.
[53] Assuming current labour can operate at 85% operating capacity. Short term reduction largely due to low labour intensity of loft insulation.

REQUIRED GROWTH IN LOW CARBON HEATING FOR NET ZERO

The high reliance on fossil fuel heating systems means that the deployment rate for low carbon heating systems will have to grow considerably to reach net zero in line with local targets. Figure 23 displays the required deployment under the Gradual Intervention scenario[54] across different low carbon heating measures. Air source heat pumps are likely to be most commonly installed with nearly 500,000 installations projected across the region. Approximately 139,000 homes will require heating controls across the region. Additionally, over 35,000 heat network connections and more than 40,000 ground source heat pump installations are required across the housing stock.

The peak installation rate under the Urgent Action scenario is in 2028, where 129,000 individual measures are installed, with 91,000 of these being air source heat pumps. Under the Balanced Approach scenario, the peak deployment rate is in 2034 where 62,900 measures are installed and under the Gradual Intervention scenario, the peak deployment rate is in 2036 where 47,000 individual measures are installed. For the Solent to reach net zero by 2050 in line with the Gradual Intervention scenario, an average annual deployment rate of 14,500 air source heat pumps, 1,500 ground source heat pumps and 1,000 heat network connections must be achieved.

Ground source heat pump installations are concentrated in rural areas where space for the ground loop is more likely to be available. Of the 2,839 ground source heat pumps installed in 2037 under the Gradual Intervention scenario, 636 are in New Forest and 503 in the Isle of Wight. Conversely, heat network installations are predominantly in urban areas with over half of the 1,843 heat network connections installed in 2038 under the Gradual Intervention scenario, in either Portsmouth or Southampton.

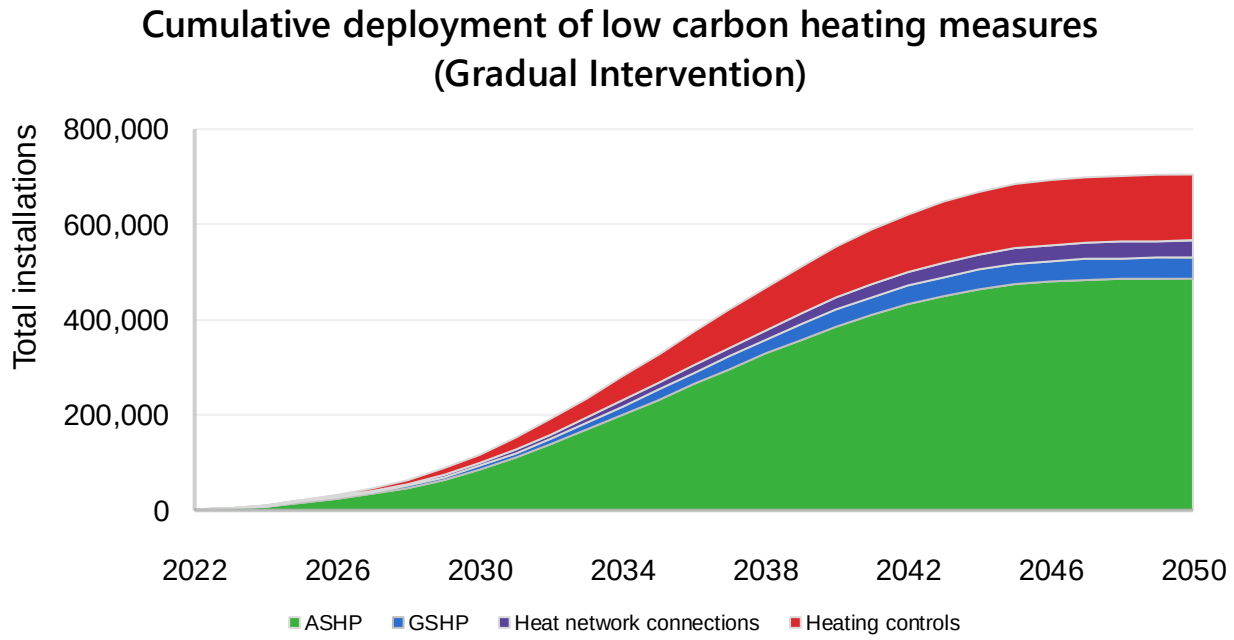

Figure 23 - Cumulative deployment of low carbon heating measures (Gradual Intervention)[55]

[54] These projections include retrofit installations and installations in new builds but not refits and replacements.
[55] Remaining scenarios can be found in annex 4.

Insulation and Retrofit

To achieve the installation rates required, mass retraining of personnel across both the servicing and construction of retrofit measures will be required. Across the installation and servicing of insulation measures, the total labour market must grow by 25% by 2036 to achieve the deployment rates required under the Gradual Intervention scenario. The employment growth required under the Gradual Intervention scenario is shown in Figure 25.

Despite the relatively low requirement for solid wall insulation in the Solent, due to the high labour intensity of solid wall insulation installations and the low current provision of labour, the largest training requirement is for solid wall insulation installers. The training requirement is most significant under the Urgent Action scenario where 655 additional installers are required by 2027. The urgent training requirement is less pronounced under the Balanced Approach scenario, with an additional 267 installers required by 2035. The Gradual Intervention scenario, which is in line with local net zero targets, **requires an additional 186 installers to be trained by 2036**.

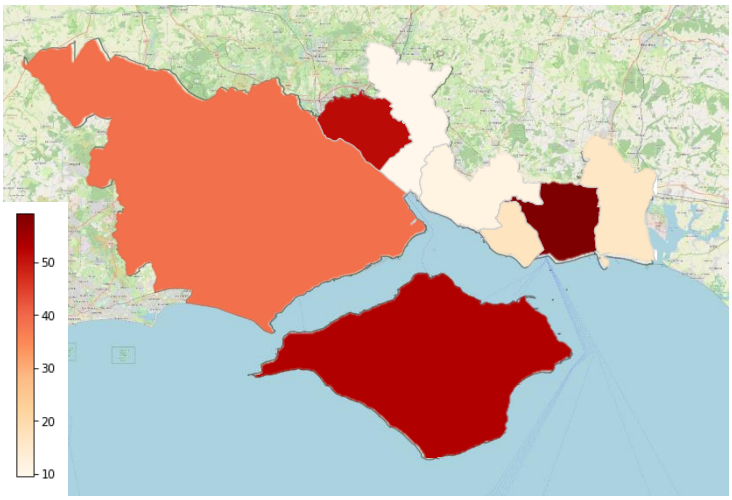

Figure 24 - Total solid wall insulation installers required in 2035 (Gradual Intervention)

Under the Gradual Intervention scenario, the **solid wall insulation installer labour market must grow by 139% by 2036**, requiring 13 installers to be trained each year on average. There is some degree of geographic concentration, as shown in Figure 24, with over 150 of the additional installers in the Gradual Intervention scenario required between Southampton, Portsmouth, and Isle of Wight.

The second highest requirement for skills relates to cavity wall insulation. It is estimated that 211 additional cavity wall insulation installers are required by 2028 under the Urgent Action scenario, an additional 70 are required by 2034 under the Balanced Approach scenario and an **additional 40 are required by 2037** under the Gradual Intervention scenario. Under the Gradual Intervention scenario, the cavity wall insulation installer labour market will need to grow by 25%, training an additional 10 installers every 4 years. Nearly a third of the requirement for cavity wall insulation installer training is from Portsmouth and another quarter from Southampton.

The requirement for new labour in the construction of energy efficiency measures is lower, owing to the high current provision of double glazing installers and the low labour intensity of loft insulation installations. Less than 5 additional installers are required between the two measures across all scenarios.

To support high quality renovation works, retrofit coordinators and retrofit assessors will be required. As these individuals advise on numerous measures within a single renovation project, the number of individuals required is generally lower. However, due to the short-term nature of the Urgent Action scenario, an additional 73 retrofit assessors and 56 retrofit coordinators would be required by 2028. Of the additional 73 retrofit assessors, 48 are required between Southampton, Portsmouth and Isle of Wight. Across the other scenarios, the requirement for

additional retrofit assessors is minimal, although 26 additional retrofit coordinators are required by 2036 under the Balanced Approach scenario and **19 additional retrofit coordinators** will be required by 2037 under the Gradual Intervention scenario. Under the Gradual Intervention scenario, the provision of retrofit coordinators will need to grow by 611% by 2036, owing to the extremely low current provision.

As insulation measures require minimal ongoing maintenance, there is likely to be a labour surplus following the installation peak. In particular, under the Urgent Action scenario there is significant surplus which could be deployed outside of the region, presenting an opportunity for growth.

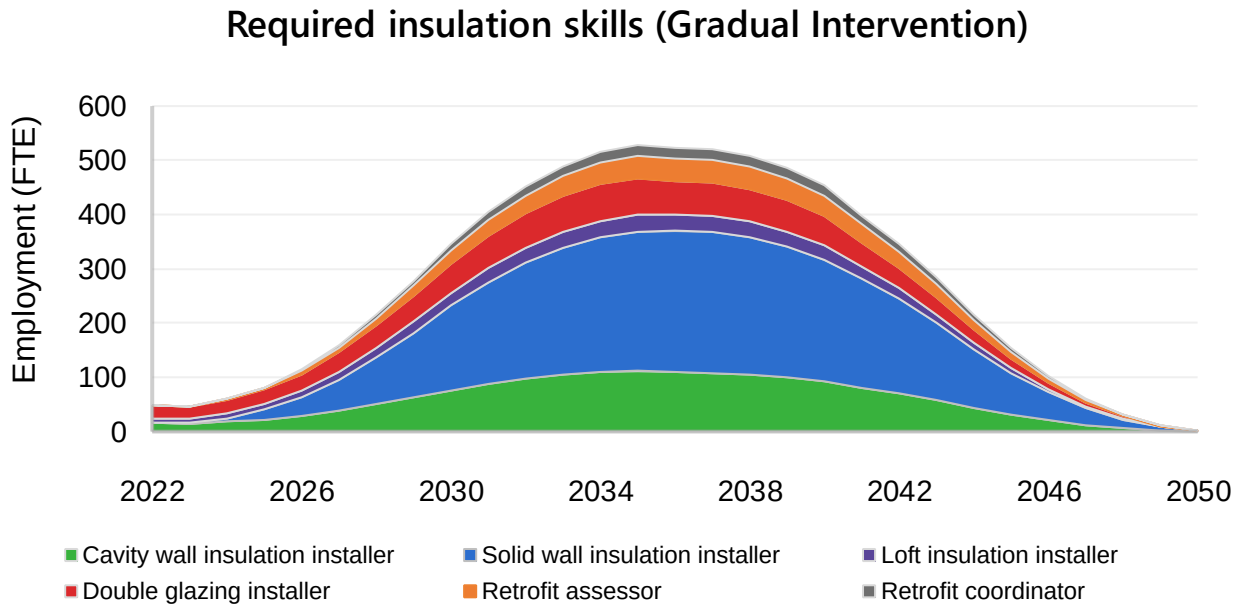

Figure 25 - Required insulation skills (Gradual Intervention)[56]

Heat pumps and low carbon heating

Significant efforts will be required to upskill labour to deploy low carbon heating systems at the required rate. Figure 27 displays the low carbon heating skills required under the Gradual Intervention scenario. The most significant skills requirement across all scenarios was for heat pump engineers. As the primary labour requirement for the install, refit and maintenance of air and ground source heat pumps, the requirement for heat pump engineers was sustained over the course of the scenarios. Due to the lifecycle of heat pumps being around 15 years for air source units and 20 years for ground source units[57], in the more urgent scenarios, there are clear distinct waves of demand. The first is where initial retrofit installs are made and the second when the first wave of installs require replacement. This results in a "boom and bust" nature to the heating industry in the Urgent Action scenario. 3,124 total heat pump engineers are required by 2028, however this falls to 1,141 by 2036 once retrofitted installations are complete, only to rise to 1,923 to service them. The required labour encompasses the demand for retrofit installations, new build installations, maintenance, and refits.

In terms of training, achieving the required numbers of heat pump engineers will be challenging. An additional 3,024 heat pump engineers will need to be trained by 2028 under the Urgent Action scenario, an additional 1,873 are

[56] Remaining scenarios can be found in annex 4.
[57] CCC (2019) The Sixth Carbon Budget: Buildings

required by 2037 under the Balanced Approach scenario and **an additional 1,557 are required by 2040** under the Gradual Intervention scenario. Under the Gradual Intervention scenario, the heat pump engineer labour market will need to grow by 2100% by 2040, meaning that an average of 83 engineers will need to be trained per year.

Of all newly trained heat pump engineers required across the region, 7% will need to be able to install ground source heat pumps. However, in areas with greater ground source heat pump penetration, this will be higher. At least 13% of the newly trained heat pump engineers in Fareham will need to be able to install ground source heat pumps. The majority of engineers are either able to install ground source heat pumps and air source heat pumps or just air source heat pumps. Very few specialise only in ground source heat pumps and there are no accredited heat pump installation businesses in the Solent that only offer ground source heat pumps. Evidence suggests that heat pump engineers do not specialise by type of property either, working between non-domestic and domestic as well as new builds and existing homes[58]. Currently, the market for ground source heat pumps is limited and so installers must diversify the services they offer. However, as the market matures and the demand for ground source heat pumps reaches a critical mass, installers may find merit in specialising their service towards either ground or air source heat pumps.

Many of these engineers will need to be new entrants whereas others can be upskilled from current skills in the region. **Up to 73%** of the heat pump engineers required by 2045 under the Gradual Intervention scenario can be accessed by upskilling fossil fuel heating engineers in the region, however in the Isle of Wight and New Forest 35% will need to come from new entrants to the market[59]. These are conservative estimates for the share of new entrants as some engineers will leave the market for reasons other than retirement and some will be unwilling to retrain (potentially due to age or doubts around the technology). It is likely that the requirement for new entrants will be greater than these estimates.

The obvious source for this additional labour is through heating apprenticeships, potentially through new low carbon heating focused courses[60]. To address the requirements for new entrants to the market, the Solent will need to train a minimum of **390 heating apprentices by 2040**.

Electricians specialising in the installation of heat pumps will also be required to assist engineers in the installation process. An additional 1,103 electricians will be required by 2027 under the Urgent Action scenario, an additional 476 will be required by 2034 under the Balanced Approach scenario and an **additional 340 will be required by 2035 under the Gradual Intervention scenario**. As engineers and not electricians are the primary provider of maintenance and operation services, the requirement for electricians declines significantly once retrofit installations are complete, although these skills are widely transferable, especially in the context of a net zero economy.

[58] BEIS (2023) Heating and cooling installer study
[59] Estimated annualised retirement rate taken from Gemserv analysis completed on the behalf of the HPA. Gemserv (2021) Heating system installers share their views on the opportunities and risks they face in the transition to low carbon. Gas Safe Register (2017) Decade review
[60] Institute for Apprenticeships and Technical Education (2022) Low Carbon Heating Technician

The rollout of heat networks, some using heat pump technology, is likely to be more prolonged and concentrated in urban areas. An additional 210 specialist heat network engineers will be required by 2028 under the Urgent Action scenario, an additional 278 by 2038 under the Balanced Approach scenario and **an additional 259 by 2045** under the Gradual Intervention scenario by 2045. The distribution of these roles is shown in Figure 26, which highlights that over half of the required skills are between Portsmouth and Southampton.

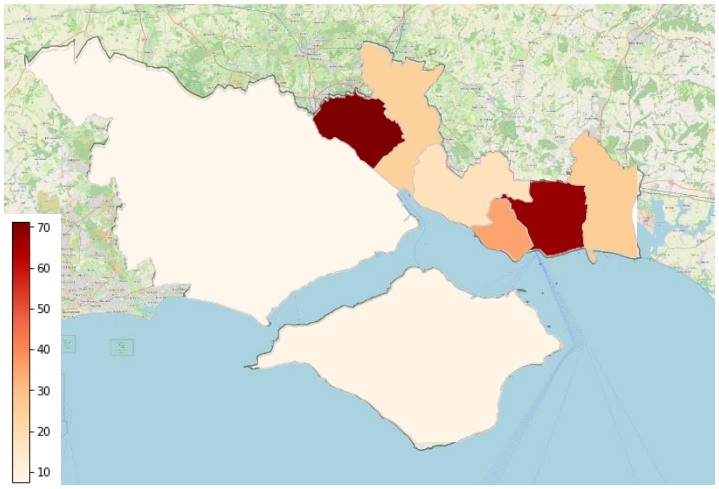

Figure 26 - Total heat network engineers required in 2045 (Gradual Intervention)

Groundworkers will be needed to prepare the ground loops[61] for standalone ground source heat pumps and heat networks that utilise ground source heat pump technology. Under the Urgent Action scenario, a total of 108 groundworkers will be required by 2028. Under the Balanced Approach scenario, 58 groundworkers will be required by 2036 and under the Gradual Intervention scenario, **45 groundworkers** will be required by 2037 (see Figure 27). Due to the low labour intensity of installing heating controls and the high current provision of installers, less than 10 additional installers will be required across all scenarios.

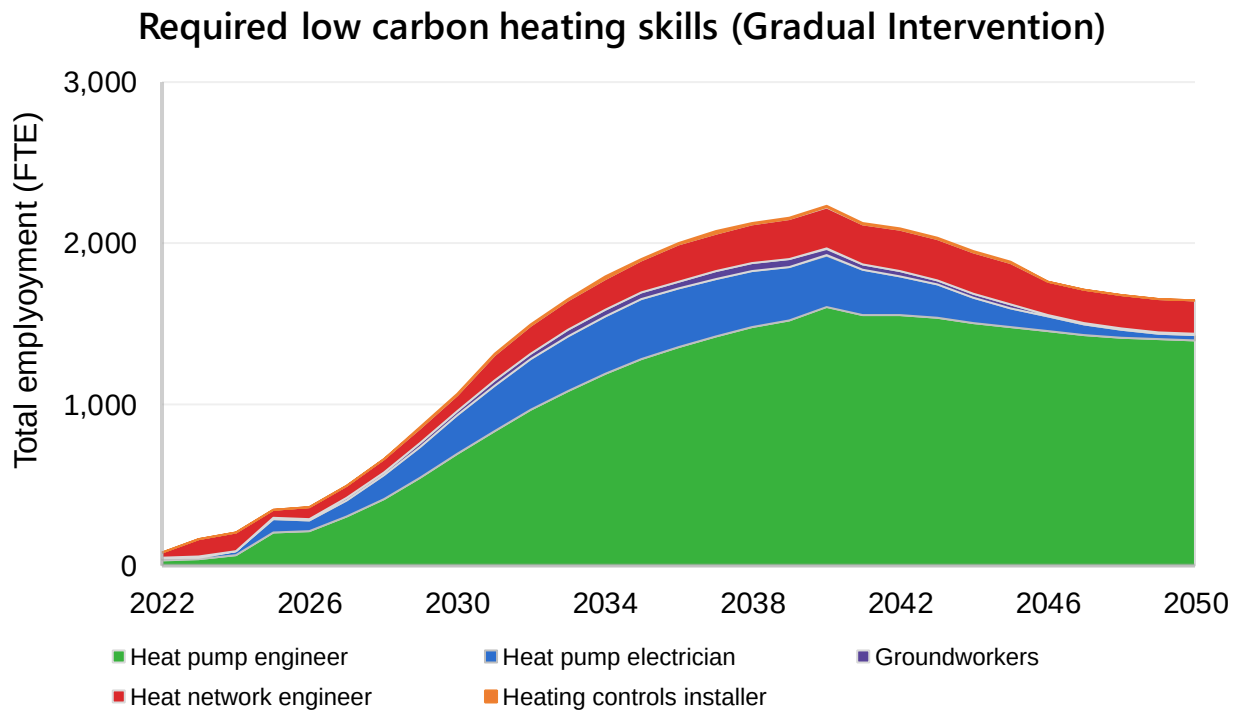

Figure 27 - Required low carbon heating skills (Gradual Intervention)[62]

[61] This includes both vertical and horizontal ground loops. Vertical ground loops will require the drilling of boreholes. Currently, to receive grant funding towards GSHP installations requiring boreholes, groundworkers must be certified in closed-loop drilling according to: MCS (2022) The MCS Specification for Ground Source Closed-loop Drilling

[62] Remaining scenarios can be found in Annex 4.

RETROFIT SKILLS PROVISION AND GAPS

Workforce skills requirements for the job roles required in the insulation retrofit and low carbon heating sectors are set out in more detail in the regional report. It details the qualification pathways for key roles and competencies, skills requirements, and courses for publicly funded retrofit work in England and Wales (including Trustmark, and PAS requirements, MCS), a map of roles, required qualifications and accreditations. There is also a list of training providers and qualifications in the South West and Solent LEP region.

Insulation

Research suggests that the insulation sector requires the following roles and their corresponding qualifications to align with PAS2030 and PAS2035 standards. Installers are required to comply with these to carry out government funded insulation retrofit in England.

ROLE	QUALIFICATION
Retrofit Advisor	**Level 3 Award in Domestic Retrofit Advice**[63] Undertaking this qualification provides official recognition of the knowledge and skills needed to become a Retrofit Advisor.
Retrofit Assessor	**Level 4 Award – Domestic retrofit assessment**[64] Undertaking this qualification provides official recognition of the knowledge and skills needed to become a Retrofit Assessor. Their job is to visit properties and carry out the survey that is required to inform the decision making about what measures should be installed. Working under the supervision of a Retrofit Coordinator, this will involve assessing the condition, occupancy and significance of the building in line with the PAS.
Retrofit Coordinator	**Open College West Midlands Level 5 Diploma in Retrofit Co-ordination and Risk Management** Demonstration of prior experience in competence in professional practices such as contract and project management, customer service etc.
Retrofit Designer	**Level 5 Diploma / MCIAT** Available to registered Architects, Construction Managers and Building Surveyors or CIBSE Members who also hold Level 5 Diploma or Specialist Traditional Building Qualifications.
Retrofit Installer	Various courses and qualifications, set out below
Retrofit Evaluator	Level 5 Diploma in Retrofit Co-ordination and Risk Management

Low carbon heating

Low carbon heating courses are less clearly prescribed than insulation qualifications and courses. They generally follow the Microgeneration Certification Scheme (MCS). The Microgeneration Certification Scheme (MCS) defines, maintains,

[63]Retrofit Academy (2023) Level 3 award in domestic retrofit advice
[64] Retrofit Academy (2023) Level 4 award in domestic retrofit assessment

and improves quality in the retrofit sector by regulating the low-carbon products and installations used to produce electricity and heat from renewable sources, and the contractors that install them.

A full list of MCS accredited and PAS:2030 and PAS:2035 courses available in the Solent can be found in Annex 2. Example learner journey routes from Level 1 to Level 7 qualifications can be found in a report developed by Ecuity Consulting LLP (2021) on behalf of the West of England Combined Authority 'Retrofit Skills Market Analysis', page 35, here.

SKILLS GAPS

The South West Retrofit and Insulation Skills report, developed through engagement with many organisations within the Solent LEP area, found that the region lacks provision of core qualifications that are vital to the training of insulation and heat pump retrofit positions.

1. There are no providers in the region that offers the City and Guilds Level 2 and Level 3 NVQ in Insulation and Building Treatments (Construction)[65]. As we have set out, these courses are critical on the pathway to key insulation installer roles across cavity, solid wall, and loft insulation.
2. Provision of relevant heat pump and retrofit apprenticeships in the region is low, with only two providers demonstrated as publicly offering apprenticeships locally. Although challenges in primary data gathering have caused difficulties in determining the true extent of the offer in the region.
3. There are no providers in the Solent LEP area that offer the Level 2 NVQ Diploma in Fenestration Installation which is key to PAS 2030 certification.
4. There are no relevant insulation retrofit or heat pump installation apprenticeships in the Solent LEP area.
5. The region is reliant on just three providers for the majority of its insulation and heat pump courses. They are:
    - Hampshire Training & Assessments Ltd, located in Havant, Hampshire
    - Business Edge Ltd (Portsmouth), located in Waterlooville, Hampshire.
    - SERT Training SERT at GFM, located in Gosport, Hampshire.

In addition, the regional report found other barriers and challenges:

- **Installation quality.** Installers lack the skills and knowledge to complete high quality installations. Despite government schemes setting regulatory standards through MCS, installers do not need to have any qualification to install privately. Overcoming the issue of a first install needs strong hands on courses, which boost learning.
- **Training and labour supply.** Retraining and upskilling the existing workforce will be challenging. Owing to the older demographic in the industry, there is a lack of motivation to upskill. When recruiting and retaining people from outside the industry, those joining must start from the bottom of industry to be properly qualified. There is also no specific low carbon heating apprenticeship, so apprentices must follow the traditional plumbing and heating route.
- **Qualifications quality.** Some MCS courses are outdated and not Ofqual approved, Level 2 heating qualifications lack detail on heating systems, which are needed for low flow temperatures. A review of the minimum technical competencies by the Department of Levelling Up Communities and Housing is occurring to raise technical competence levels.

[65] City and Guilds (2022) Insulation and Building Treatments

More broadly, the rapid roll-out of energy efficiency measures in UK buildings will require thousands of skilled workers in construction and other related trades. Research by the Construction Industry Training Board suggests that decarbonisation measures according to the CCC's "balanced pathway" could require more than 200,000 new jobs in the buildings sector by the mid-2020.[66] Lead times for training and upskilling – for new entrants and reskilled workers – means that in many cases training needs to start now for enough skilled workers to be in place to meet inflated future demand for energy efficiency measures. A dearth of skilled workers is already often reported as a limiting factor holding back the scale up of home retrofits.[67] Failing to properly address these issues will cause supply chain bottlenecks that will hamstring the drive to decarbonise UK buildings. Broadening the availability of training opportunities is essential to Increase capacity within the supply chain by increasing the number of skilled individuals.

Construction is one of the industries in the Solent facing the most acute local skills shortage. According to the Solent's Local Skills and Labour Market Analysis, published in June 2020, almost a half (46%) of all vacancies in this sector in the Solent are skill-shortage vacancies, which is well above the Solent average (20%).[68] Skills gaps within the existing construction workforce represent a big obstacle to the delivery of energy efficiency measures in the region. The market for energy efficiency measures is expected to undergo substantial growth in the next ten years because of increased organic demand and government policies. However, 20-25% of the construction workforce is set to retire within the next decade, which has the potential to exacerbate pre-existing skills shortages.[69] There is a serious risk that a lack of supply chain capacity could become a limiting factor that will prevent the Solent from meeting its energy efficiency objectives. New entrants must be recruited into the workforce to plug current gaps and prevent future shortages from occurring down the line when a significant proportion of the current workforce reaches retirement.

[66] Energy Monitor (2022) How much is the UK government really spending on its new insulation plans?
[67] CCC (2022) Progress in reducing emissions
[68] Solent LEP (2022) Solent Skills Advisory Panel Local Skills and Labour Market Analysis
[69] Friends of the Earth (2021) EMERGENCY_PLAN_GREEN_JOBS_FEB_2021.pdf (friendsoftheearth.uk)

TRANSPORT AND LOGISTICS

LOW CARBON TRANPSORT POLICY

In 2021, the government published its Transport Decarbonisation Plan which sets out the government's planned pathway to net zero transport in the UK and highlights the benefits of net zero transport. This plan sets out some key strategic priorities to reducing emissions in the domestic transport sector:

- Accelerating the shift to public transport and active transport
- Decarbonising road transport
- Decarbonising how goods are transported[70].

ROAD TRANSPORT

Road Transport Policy

The most significant policy in achieving decarbonisation of road transport is the phase out of the sale of all new non-zero emission vehicles by 2040. In addition to this overall target, the UK has committed to end the sale of:

- New petrol and diesel cars and vans by 2030.
- New hybrids including plug in hybrid cars and vans by 2035.[71]
- New non-zero emission heavy goods vehicles (HGVs) weighing 26 tonnes and under by 2035.
- All new non-zero emission HGVs by 2040.[72]

In addition to phase out dates for fossil fuel vehicles, the government provides a number of grants for EV charging, including the *EV chargepoint grant* and the *Workplace Charging Scheme,* which provide a contribution to the upfront cost of installing EV chargers[73].

Current Uptake and Charging Infrastructure

Battery Electric Vehicles (BEVs) are the primary route to decarbonisation for road vehicles. The number of battery electric vehicles in the Solent has experienced a significant increase since 2020. However, uptake for larger vehicle types has not followed this trend with zero battery electric buses, coaches or HGVs registered in the Solent area at the start of Q3 2022.

[70] DfT (2021) Decarbonising transport: a better, greener Britain
[71] DfT (2021) Outcome and response to ending the sale of new petrol, diesel and hybrid cars and vans
[72] DfT (2021) UK confirms pledge for zero-emission HGVs by 2040 and unveils new chargepoint design
[73] OZEV (2022) Grant schemes for electric vehicle charging infrastructure

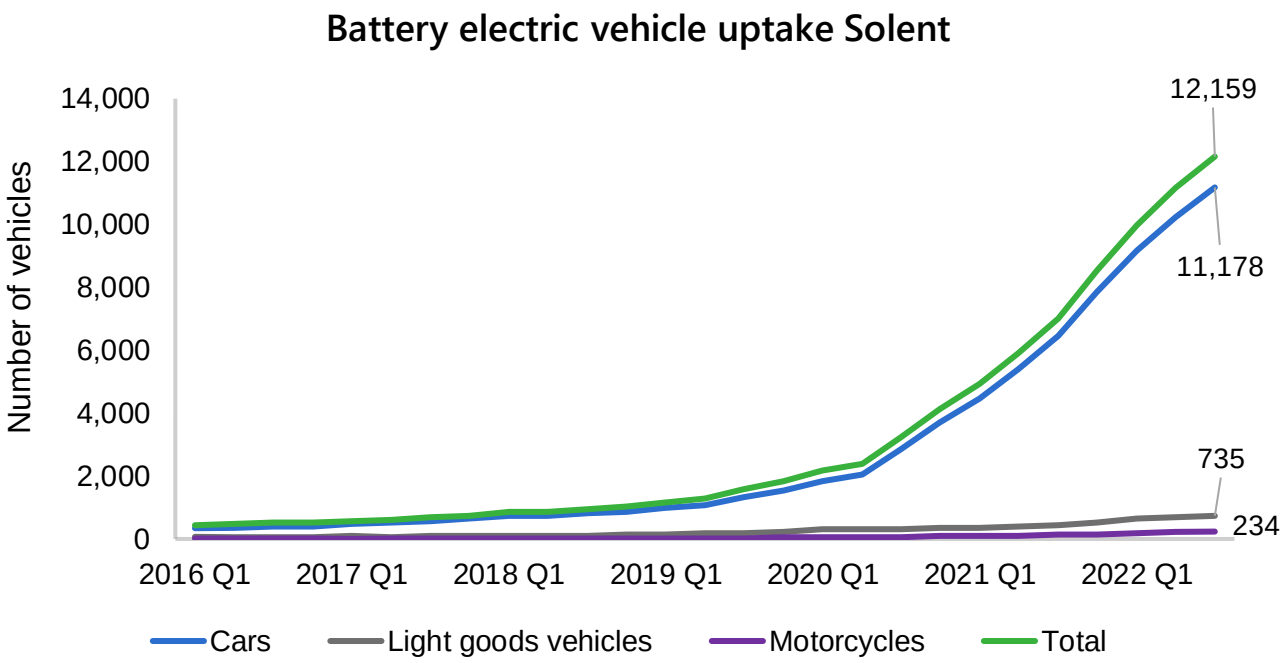

Figure 28 - Battery Electric Vehicle Uptake 2016 - 2022

A growing number of charge points are needed to service this increasing electric vehicle stock. The Government have committed to £1.5 billion to address infrastructure challenges, with the stated aim of installing 300,000 public charging points in 2030. However, given that last year, less than 9,000 new public charging points were installed, there is some concern that the Government will miss its target without urgent and substantial action and investment in electric vehicle (EV) infrastructure. A recent report by New AutoMotive suggests that the charge point roll out is growing by a third every year and that if the current installation rate nationally continues that the UK could be on track to achieve the 2030 target[74]. Our analysis indicates that the number of public EV chargers has grown at a slower rate than uptake of battery electric vehicles, as shown in Figure 29 below.

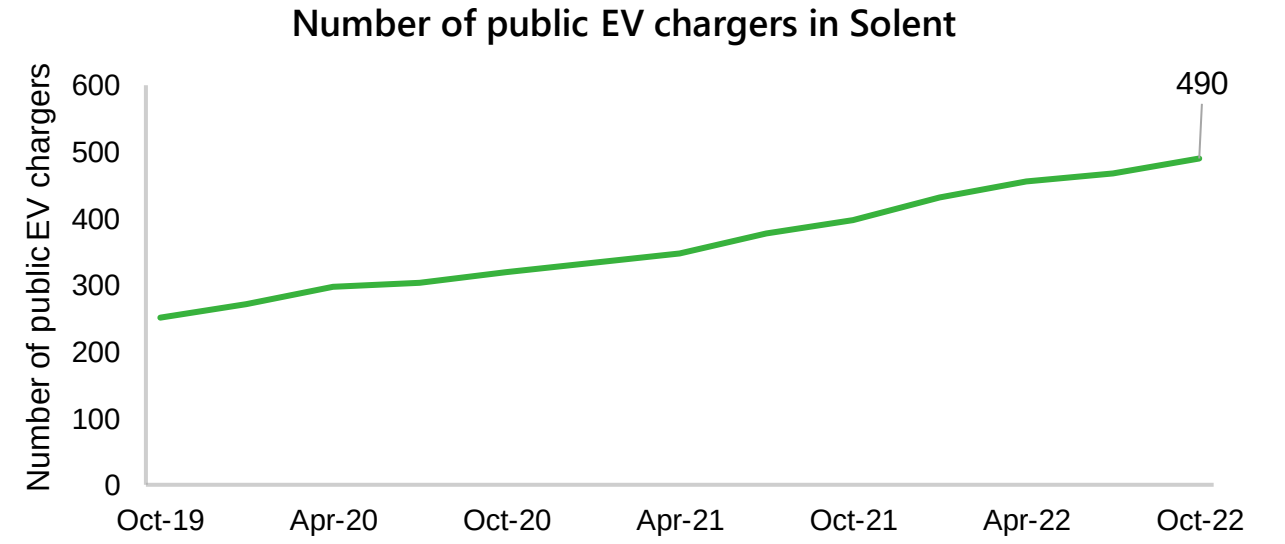

Figure 29 - Number of Public EV Chargers In Solent 2018 - 2022

[74] AutoMotive (2023) On the Road to Net Zero

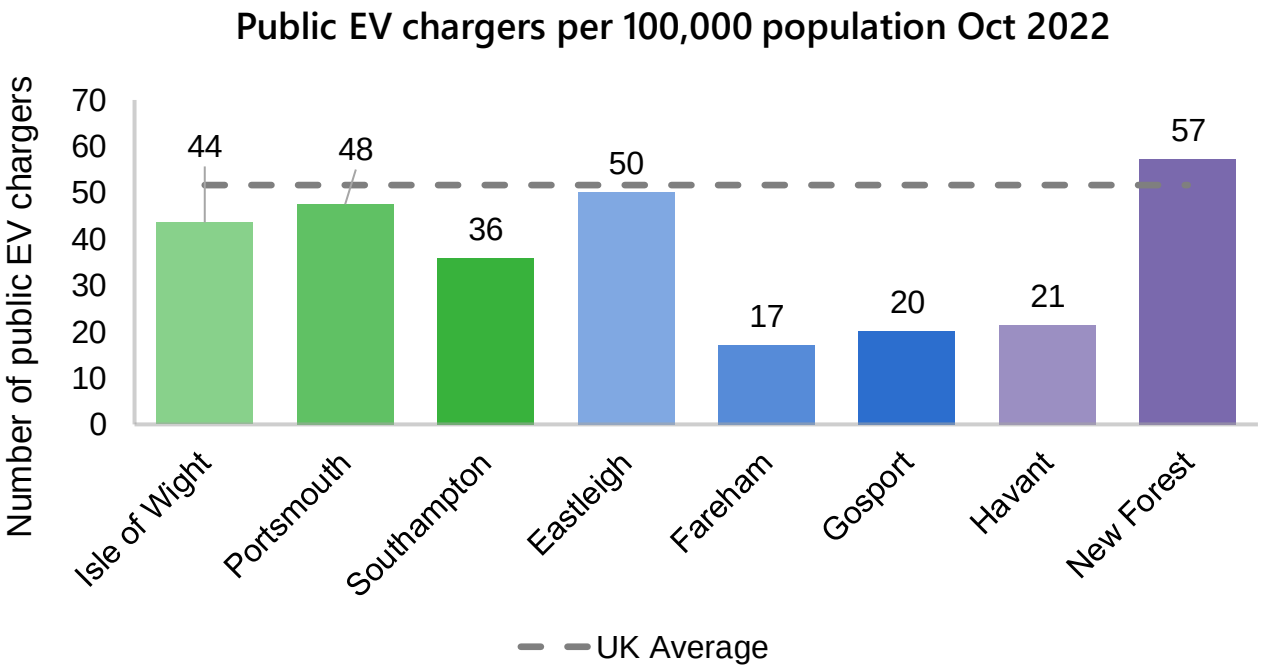

Figure 30 - Public EV Chargers per 100,000 Population Oct 2022 by Local Authority

All the LAs within the Solent, except the New Forest, have fewer public chargers per person than the average for the UK. However, the UK average is skewed by the high density of EV charge points in London where there are 131 public chargers per 100,000 people[75].

Rapid charge points are defined as having a power rating above 25kW. These are vital for providing the fast charging needed for cars stopping to charge during a journey but also for heavy duty vehicles due to their larger battery size. The graph below shows the number of public EV chargers rated as rapid or above in the Solent region. It is interesting to note the high number of rapid public EV chargers in Havant compared to the region and the national average.

[75] DfT (2023) Electric vehicle charging device statistics: January 2023

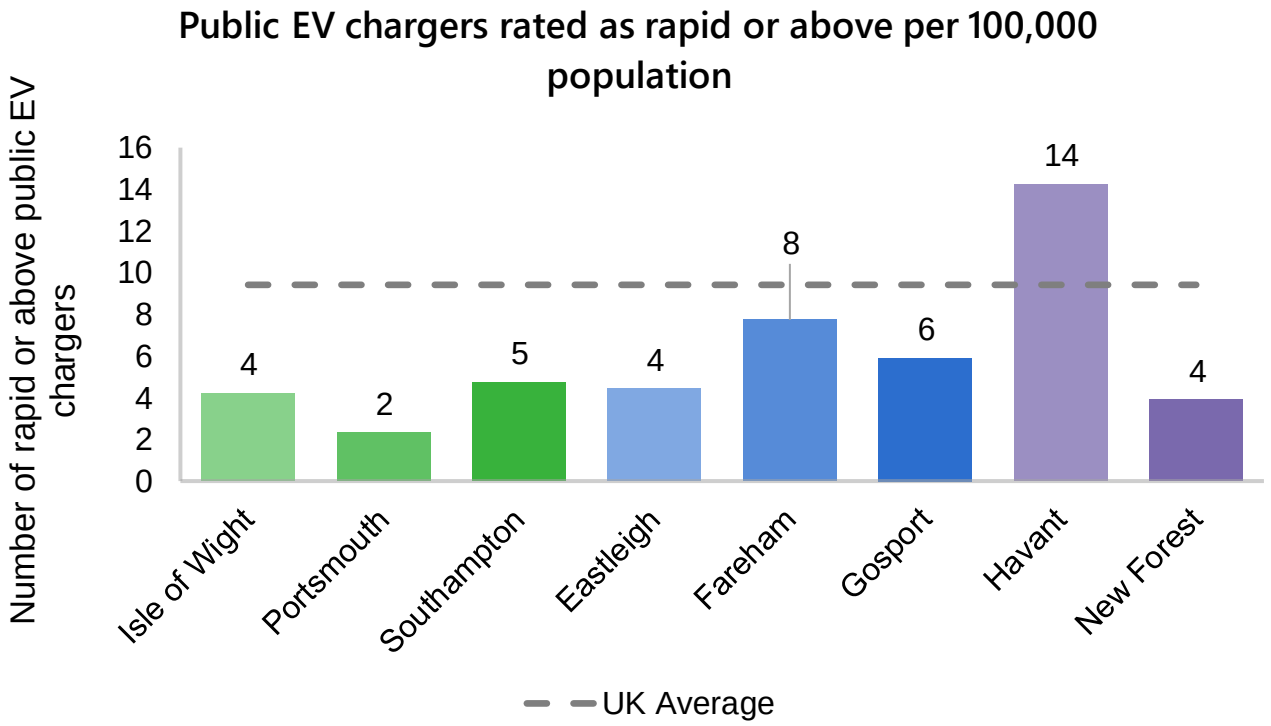

Figure 31 - Public EV Chargers Rated as Rapid or Above per 100,000 Population Oct 2022 by Local Authority

Overall, the deployment of EV chargers is dominated by domestic installations, with roughly fifteen times the number of domestic installations as there are public. As reported by Department for Transport (DfT), as of January 2022 there were 431 public EV charge points in the Solent region. Our analysis suggests that Solent is home to another 6,494 domestic EV charge points. This results in a total of approximately 6,925 charge points for the region.

Amongst the different local authorities, Portsmouth reports the highest number of charge points (3674). This is reflective of the distribution of electric vehicles across the local authorities with Portsmouth alone accounting for 55% of the fleet as of end 2021.

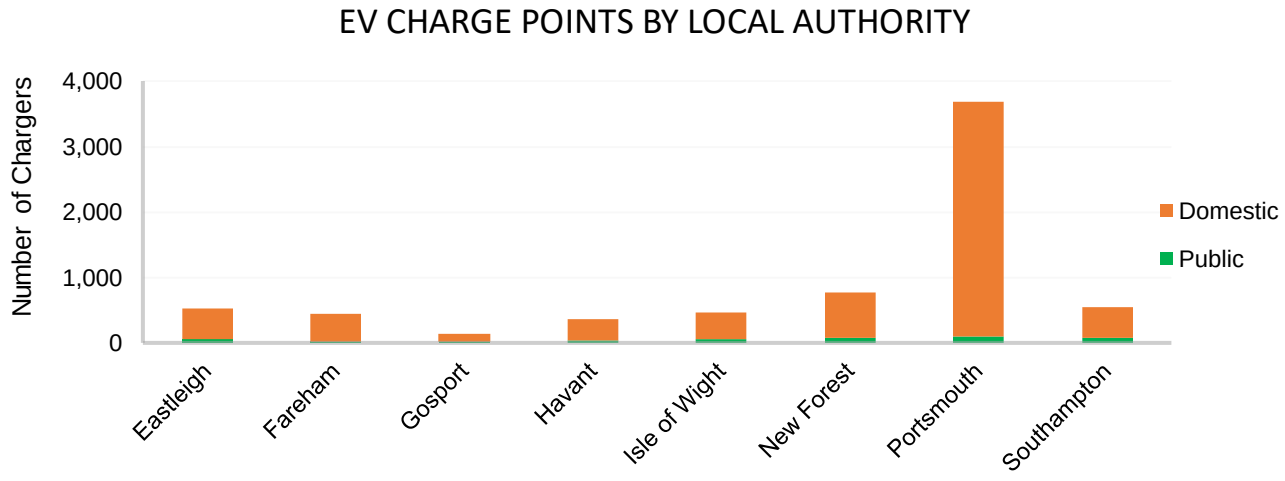

Figure 32 - Estimated number of EV charge points by Local Authority

Electric Car and Charge Point Deployment Projections

Our projections, based on DfT data[76] and the CCC's Balanced Pathway[77] in the Sixth Carbon Budget, suggest that by 2050, the Solent will require approximately 830,000 EVs. Currently the region is home to only 8,545 EVs requiring an overall increase of 19% on average per year to achieve a 100% electric fleet by the national 2050 net zero target.

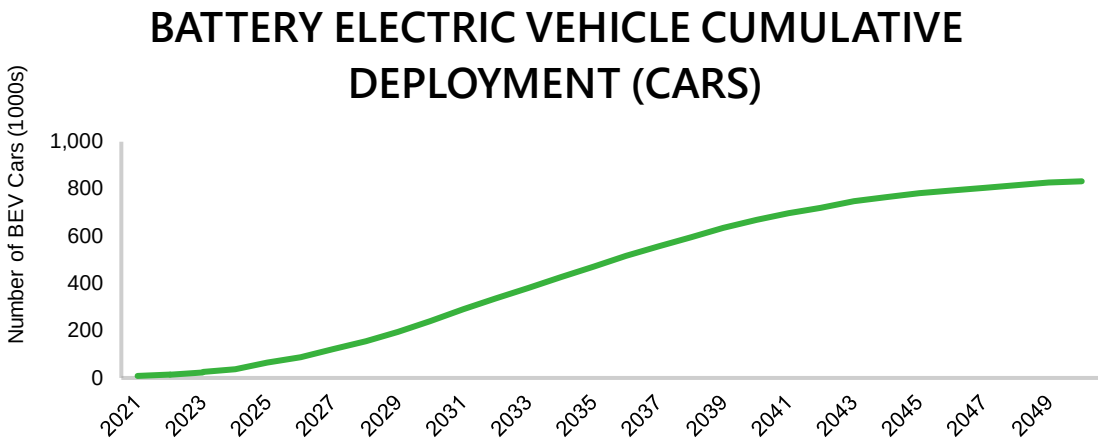

Figure 33 - Cumulative deployment of BEV cars in Solent

To meet the net zero target, a total of approximately 650,000 EV charge points will need to be installed by 2050, comprising of around 630,000 domestic and 20,000 public charge points in the Solent. The demand for public chargers, while modest, remains crucial throughout the analysis period due to two reasons. Firstly, a significant share of households (24%)[78] do not have access to off-street parking and thus, rely on these chargers. Second, public chargers are needed for on the go charging.

The yearly deployment curve to achieve this target, as depicted in Figure 34, is expected to follow a bell shape. This is due to an increasing demand for EVs and concomitant charge points until the mid-2030s followed by a steady decline as a result of near complete adoption of EVs closer to 2050.

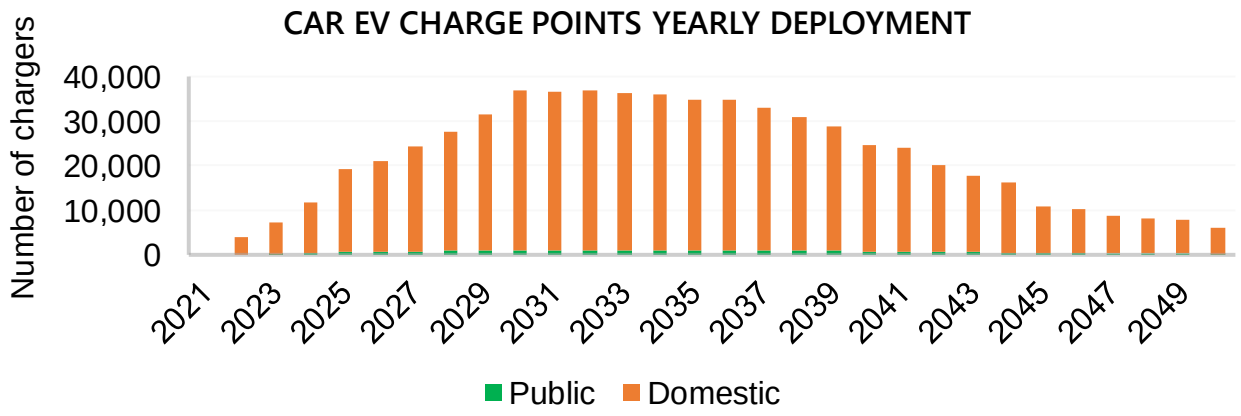

Figure 34 – Estimated annual deployment of EV charge points in Solent

[76] DfT (2022) National road traffic projections
[77] CCC (2020) The Sixth Carbon Budget Dataset
[78] DfT (2022) Public Electric Vehicle Charging Infrastructure

Low Carbon Heavy Goods Vehicle Deployment Projections

Heavy Goods Vehicles (HGVs) are an important feature of the road transport in the Solent due to the ports in the region which trade a significant amount of freight. This is explored in more detail in the green maritime section. There were 7,183 HGVs registered in the Solent area at the start of September 2022.[79] However, this metric potentially misses the scale of the traffic that passes through the region but is registered elsewhere. As an example, there were on average 9,973 HGVs daily passing a point on the M3 approximately 10 miles North of Southampton Port[80]. This metric includes vehicles travelling in both directions so may result in some double counting if vehicles travel both north and south along this route in the same day.

Decarbonisation for HGVs is likely to involve a mix of battery electric and hydrogen solutions. The Future Energy Scenarios 2022 produced by National Grid show the potential proportions of Battery Electric Vehicles (BEVs) and Fuel Cell Electric Vehicles (FCEVs) in the HGV vehicle stock. Their analysis suggests that between 45% and 93% of HGVs will be electric in 2050 with the remainder (7% - 55%) being hydrogen FCEVs.[81]

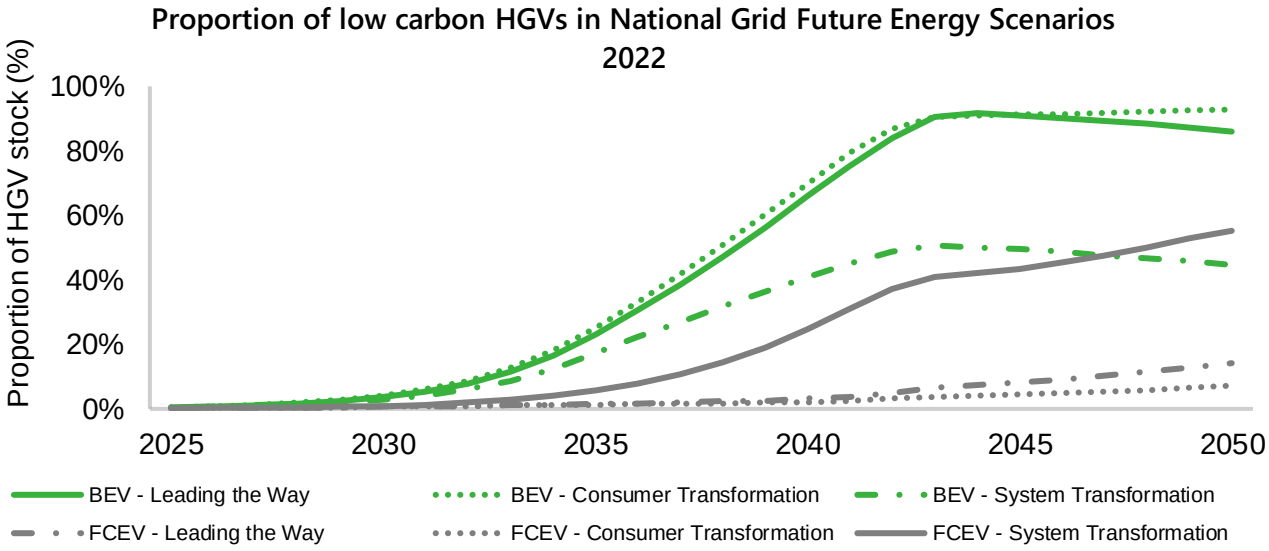

Figure 35 - Proportion of low carbon HGVs in National Grid FES 2022

Applying these vehicle proportions and assumed growth rates in HGVs to the number of HGVs registered in the Solent gives a wide range of potential low carbon HGV deployment for BEV and FCEV vehicles, although the range is much larger for FCEV vehicles as shown in Figures 36 and 37.

[79] DfT (2022) Vehicle licensing statistics data tables: VEH0105
[80] DfT (2022) Road traffic statistics - Site number: 9041
[81] National Grid (2022) Future Energy Scenarios Data Workbook

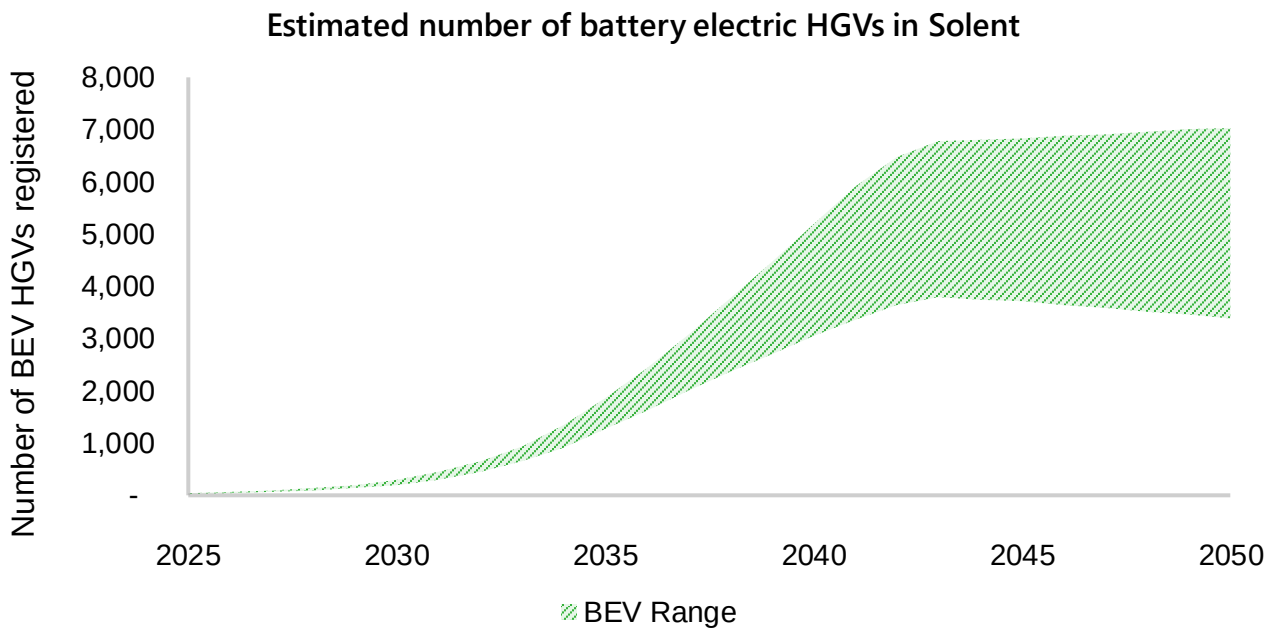

Figure 36 - Estimated number of BEV HGVs in Solent

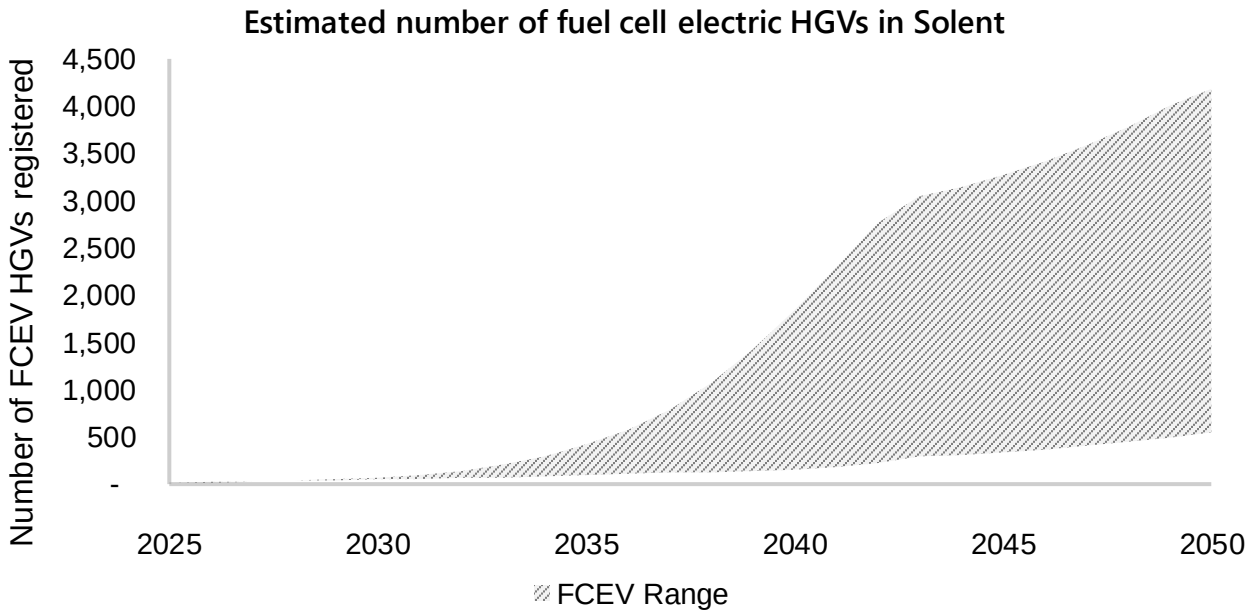

Figure 37 - Estimated number of FCEV HGVs in Solent

Road Transport Skills Requirements

The dominant skills requirements for decarbonising the transport and logistics sector in the Solent are in delivering the infrastructure required for low emission transport. This will primarily be electrical skills, including EV charger installation and grid connection. However, depending on the future role of hydrogen in transport, there could be broader skills requirements such as construction and engineering skills that are necessary for the delivery of hydrogen refuelling stations.

Our modelling suggests that the region is expected to experience an average annual growth rate of 19% for charge point deployment. To carry out these installations, an average of 237 installers will be required per year with 394 required in the peak year alone. Since the number of installers required per year to facilitate the fulfilment of the projected EV charge point installations is directly proportional to the yearly deployment of EV charge points, it follows the same bell shape trend that peaks in 2032 and declines rapidly thereafter as the requirement for new charge point tails off from the 2040s (see Figure 38).

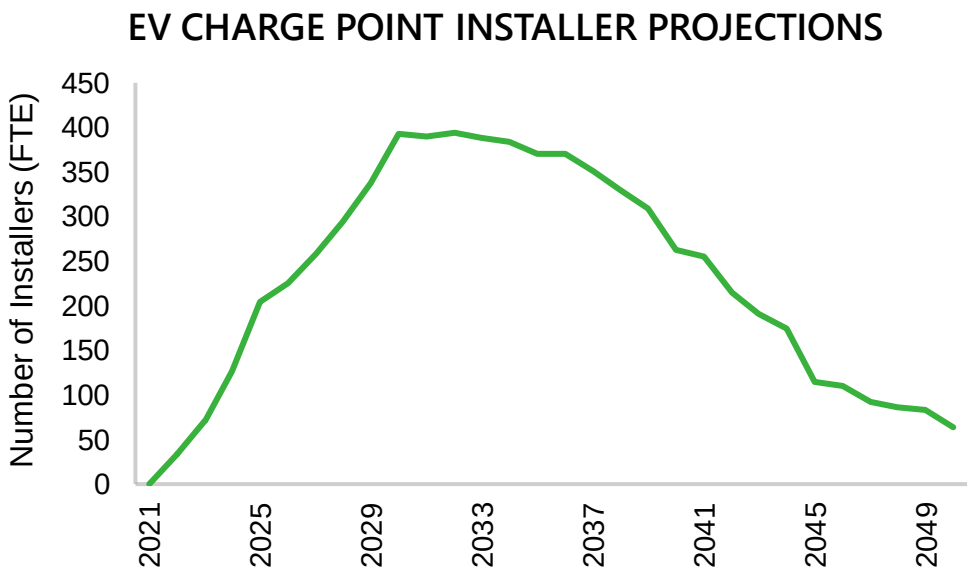

Figure 38: EV charge point Installer projections

This initial increasing and eventually falling trend indicates the need for a higher number of installers in the 2030s and 2040s and relatively lower in the latter two decades suggesting that local authorities, institutions, and governments should focus on rolling out training positions rapidly in the coming years. For instance, between now and peak employment requirement in 2032, an additional 36 installers need to be trained each year on average, amounting to providing additional training for 364 installers in total.

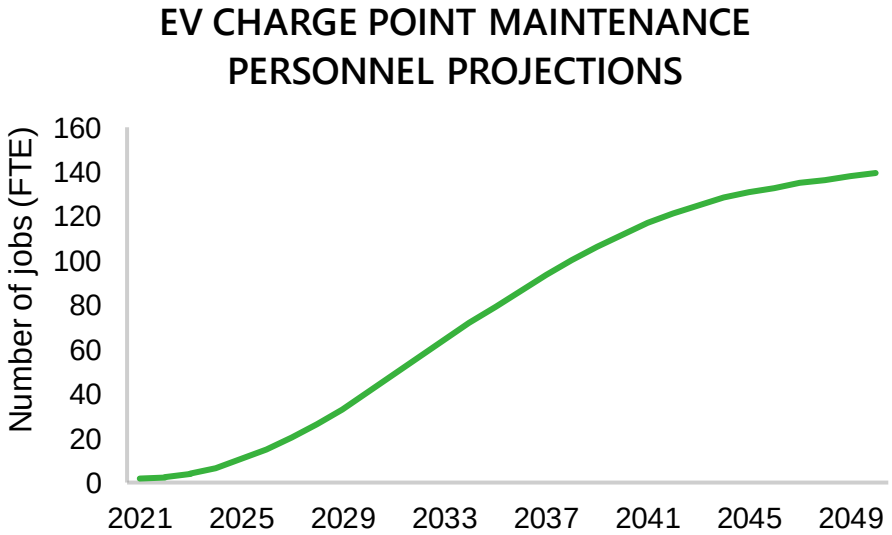

Figure 39: EV Charge point maintenance personnel projections

On the other hand, maintenance personnel requirements follow an increasing trend throughout because, as expected, maintenance is needed on the entire charge point stock and not just those deployed on an annual basis. So, Figure 39 follows the same trend as the graph for cumulative deployment of charge points. Taken together, we would expect an evolution of the workforce, starting initially with deployment of charging infrastructure in the 2020s and early 2030s and evolving away into maintenance of the infrastructure as it reaches maturity in the 2040s and 2050s.

The requirements for charge point installers and maintenance workers are more uncertain for HGVs due to the potential for hydrogen FCEVs to play a role in heavy goods transport.

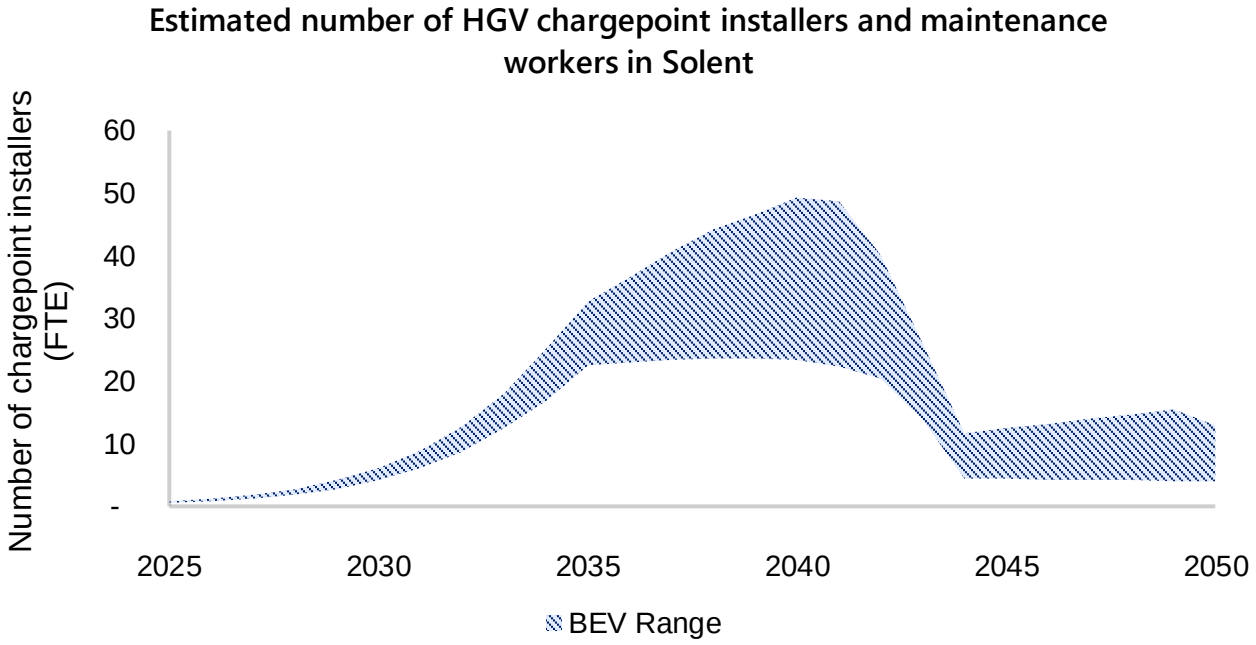

Figure 40 - Employment in BEV HGV charge points in Solent

The skills required for HGV charging are likely to be similar to those required for cars, however there will be a greater focus on working with higher voltages due to the need for higher charging speeds for larger vehicle types.

Low Carbon Road Transport Skills Provision in the Solent

Analysis based on the employment intensities of charging point installations suggests that the Solent's demand for charge points is currently catered to by 20 installers with 8 installers focused on public installations and 12 on domestic. These numbers must be interpreted with some caution since they refer to full time equivalent jobs. Under the current state of the market, EV charge point installers are likely to distribute their resource towards other engineering projects as well, hence the total people with the required skills are likely to be higher than the full-time equivalent job numbers.

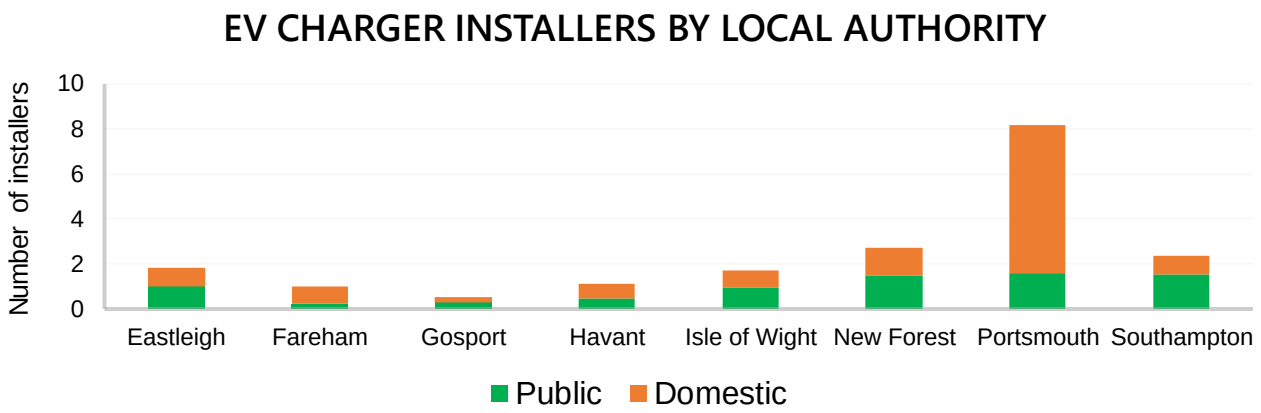

Figure 41 - EV charge point installers by Local Authority

Any qualified electrician can install EV charge points. However, to qualify for government grants, installers must be registered as an authorised installer with the Office for Zero Emission Vehicles (OZEV). This requires being a part of one of the approved competent person schemes which require you to have passed a City and Guild accredited course in EV charge point installation.[82]

City and Guild offer three qualifications in EV charging that replace the 2919 standard, these are:

- 2921-31 Design and installation of domestic and small commercial electric vehicle charging installations.
- 2921-32 Design and Quality Assurance of Largescale electric vehicle charging installations.
- 2921-33 Installation and maintenance of Largescale electric vehicle charging installations.

Currently only one of these courses is offered in the Solent region. The Southampton Engineering Training Association (SETA) offers the 2921-31 course focused on small and domestic EV charging installations.[83] However, there are three locations in the area that offer the 2919 qualification. These are likely to transition to the 2921 qualification once 2919 expires, with last registrations on 31st July 2023. These training centres are SETA, Brian Scaddan Associates and Hampshire Training and Assessments, which are shown on the adjacent map (Figure 42). Training provision will need to be scaled rapidly to ensure there are enough EV charge point installers to meet the rapidly growing demand that comes with the increasing uptake of electric vehicles.

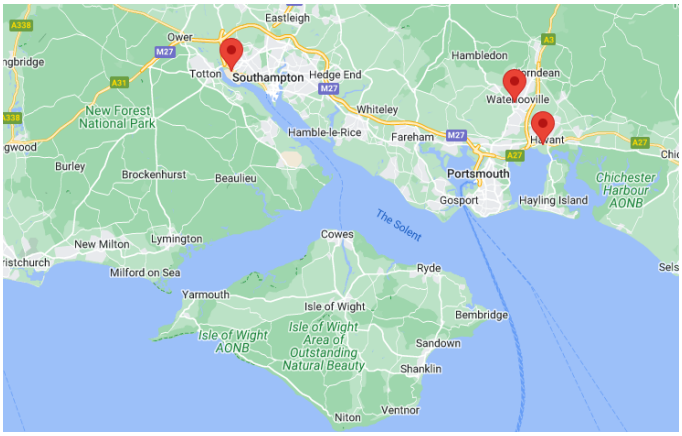

Figure 42 - EV charge point Installation Training Locations in Solent

[82] OZEV (2022) Residential and commercial chargepoints: become an authorised installer
[83] SETA (2022) ELECTRICAL VEHICLE CHARGING (C&G 2921-31)

AVIATION

Aviation Policy

There have been a number of recent policy developments related to the decarbonisation of the aviation sector, including a sustainable aviation fuel (SAF) mandate which will be introduced in 2025 and require at least 10% of aviation fuel to be made from sustainable sources by 2030[84]. There is also expected to be progress in the effectiveness of the Emissions Trading Scheme (ETS) at reducing aviation emissions in the near future. The ETS incentivises emissions reductions by applying a carbon price to emissions through the allocation of emissions allowances which firms usually have to pay for. Currently, the vast majority of aviation allowances are allocated for free, effectively placing a carbon price of zero on most aviation emissions, although operators could sell allowances at a profit if they achieved emissions reductions. A recent government consultation outlined options to reduce free allocation of aviation allowances so that full auctioning of emission allowances occurs either in 2026, 2028 or 2031.[85] This would increase the cost of air travel with fossil fuels and create incentives for decarbonisation of aviation.

Low Carbon Aviation Deployment in Solent

Southampton Airport is one of the first airports in the UK to be classified as carbon neutral. Since May 2020, all CO_2 emissions from the airport have been offset.[86] However, it should be noted that this only includes airport emissions and not emissions of aircraft, other than the landing and take-off cycle emissions which occur at heights below 3,000 feet.[87]

In 2019 Southampton Airport produced a document outlining their vision for sustainable growth. While this document does not detail any plans for decarbonisation of air travel, it does highlight the scale of expected aviation growth. The vision expects that the number of annual passengers using Southampton Airport will increase from just over 2 million in 2018 to 4 million in 2027 and 5 million in 2037[88] due to the proposals for a third runway. This growth in forecast aviation must be partially displacing air travel from other airports for the growth to be consistent with CCC projections for aviation in the UK which allow for a 25% increase by 2050 under their Balanced Pathway Scenario.[89] The CCC expect there to be significant residual emissions in aviation in 2050, with emissions only reducing by 40% between now and 2050 in the Balanced Pathway, these residual emissions will need to be offset by greenhouse gas removal. The emissions reductions are split between efficiency savings, including 8% of flights being hybrid electric, and use of sustainable aviation fuels.

The annual fuel demand shown on Figure 43 below has been estimated by using a combination of the CCC's Sixth Carbon Budget Balanced Pathway[89], DfT[90] and Southampton Airport statistics[88]. The proportion of low carbon fuels could be greater than this if there is local SAF production, with early-stage plans for production in the area which could come from Fawley Refinery or a new plant[91].

[84] DfT (2022) Mandating the use of sustainable aviation fuels in the UK
[85] BEIS (2022) Developing the UK ETS
[86] Southampton Airport (2020) Southampton: a carbon neutral airport
[87] Ricardo (2021) Southampton Airport Carbon Footprint 2021
[88] Southampton Airport (2019) Southampton Airport A Vision For Sustainable Growth
[89] CCC (2020) The Sixth Carbon Budget
[90] DfT (2022) AVI0102: Air traffic by type of service, operator and airport
[91] IDRIC (2022) Solent Industrial Cluster

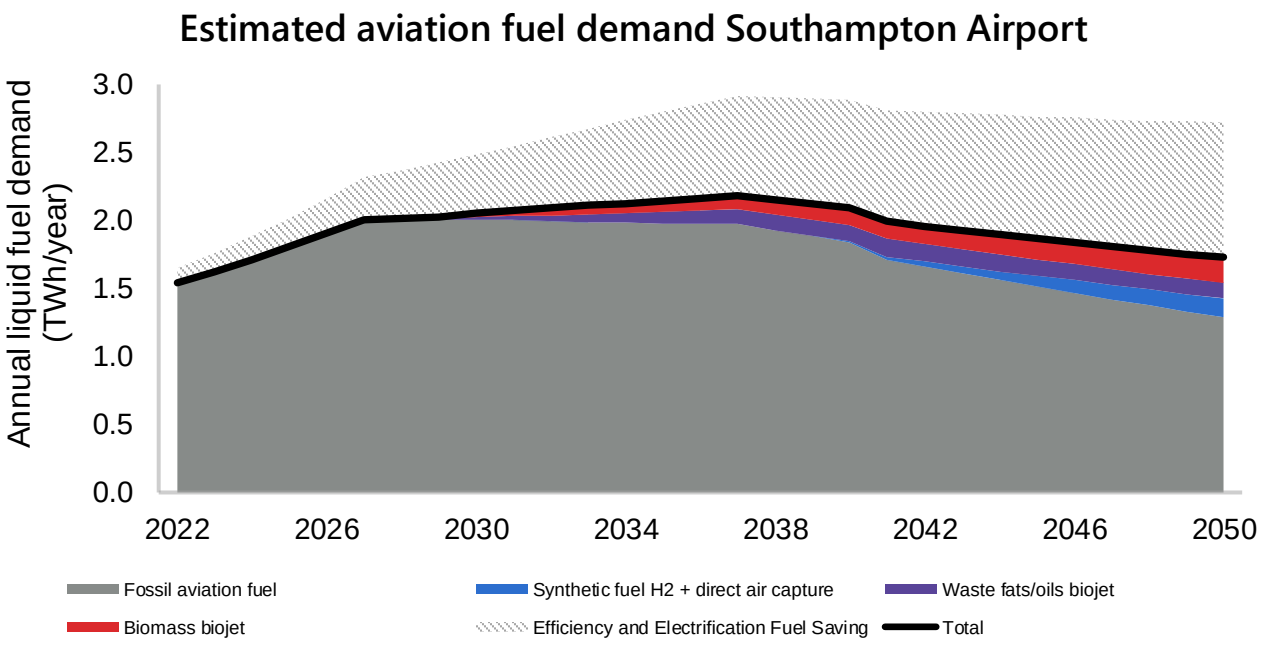

Figure 43 - Estimated Aviation Fuel Demand Southampton Airport 2022 - 2050

The figures are estimated by taking the proportion of passenger departures from Southampton Airport as a proportion of the UK total and applying this estimate to the CCC's Balanced Pathway projections. This approach factors in the projected growth of Southampton Airport and a growth in UK passenger numbers by 25%. However, there are some limitations to this estimate due to scaling down national figures. As an example, if Southampton Airport has a higher proportion of short haul flights than the UK average then this method could overestimate the fuel demand of Southampton.

Aviation Skills Requirement

As aircraft manufacture will continue to occur outside of the Solent and fossil fuels are likely to be the dominant fuel in 2050, the skills requirements for aviation are likely to be limited. The skills requirements for efficiency improvements will be based in the regions with aircraft manufacture. However, there will be some skills requirements for the transition to SAF production and electrification.

SAF skills requirements will depend on whether it is more cost effective to produce SAFs in the Solent or import from other regions. Sustainable Aviation (SA) estimate that 20,000 jobs could be created in SAFs by 2035. However, while they highlight the industrial clusters as key areas of potential production, Southampton is not mentioned as an area with high potential for first SAF production in 2025.[92] In the longer term, there is potential for Southampton Airport to have access to locally produced hydrogen which could allow the production of synthetic fuels locally, however these are likely to be more expensive than biofuels.[93] There is also potential that SAF production could be based near areas of large demand, the London airports combined had over 70 times the number of passengers as Southampton Airport in 2017.[94] However, there is some early indication that the Solent could be an exporter to Heathrow and Gatwick airports,

[92] SA (2022) Update on UK Sustainable Aviation Fuel potential
[93] CCC (2020) The Sixth Carbon Budget
[94] DfT (2022) AVI0102: Air traffic by type of service, operator and airport

however SAF production capability has not yet been quantified.[95] The skills requirements for both synthetic fuels and biofuels for aviation will have similar requirements to the production of other low carbon fuels mentioned in this report, such as chemical engineering, mechanical engineering and construction. As biofuels and synthetic fuels are drop-in replacements or can be blended with fossil fuels, there will be very little change in skills requirements for SAFs other than in production.

The electrification of aviation has more specific local skills requirements due to the installation of charging infrastructure at the airport. It is expected that skills requirements will be similar to the requirements for EV charging infrastructure. The larger batteries in aviation and the requirement for quick charging could result in skills requirements more similar to rapid EV charger installers than domestic EV charger installers.

[95] IDRIC (2022) Solent Industrial Cluster

HYDROGEN

HYDROGEN POLICY

There have been significant policy developments in the past few years in the hydrogen sector. In the Ten Point Plan, released in 2020, the government announced a 5GW low carbon hydrogen production target for 2030.[96] Since this initial target, several policy documents have been released to progress the delivery of low carbon hydrogen in the UK. This included a doubling of the production target to 10GW by 2030 in the Energy Security Strategy, with a requirement that at least half of this must be electrolytic production.[97]

Hydrogen policy is complicated due to the range of potential production methods and end uses for this energy carrier. Different forms of production have different cost bases, while different end uses are competing with different fuels so also require varying levels of subsidy support. Addressing these challenges and the requirement for dynamic subsidy support for hydrogen has been attempted by the Hydrogen Production Business Model (HPBM) in which subsidy level depends on several factors including capital cost, energy costs, natural gas price and sales price of hydrogen[98]. The outcome of this business model is that producers can make a profit by selling hydrogen at the same price as natural gas, although they are incentivised to sell at a higher price. In addition to the HPBM, the government introduced the Net Zero Hydrogen Fund (NZHF), which is a £240m fund that supports production projects with development expenditure (DEVEX) and capital expenditure (CAPEX)[99].

The carbon intensity of hydrogen production can vary significantly. Grey hydrogen, which is produced from fossil fuels without carbon capture, utilisation and storage (CCUS) produces more carbon emissions than the fossil fuels it is made from. However, hydrogen produced with CCUS or from renewable electricity can have very low emissions. Hydrogen from biomass with CCUS can even have the potential for significant negative emissions. For hydrogen to receive policy support from the HPBM, it must meet the Low Carbon Hydrogen Standard (LCHS)[100], however, there is potential for this to become more stringent over time as energy sources decarbonise and technologies improve.

The development of hydrogen produced with CCUS, where carbon is captured and stored geologically, also depends on the cluster sequencing process due to the requirements for CO_2 transport and storage infrastructure. This process identifies the order in which CCUS clusters come online through competition, with the government targeting two large scale industrial clusters by the mid-2020s, and a further two by 2030.[101]

In addition to policy for production, the Government has begun work on developing policy for hydrogen transport and storage by releasing a consultation on Hydrogen Transport and Storage Business models[102]. This consultation indicates

[96] BEIS (2020) The ten point plan for a green industrial revolution
[97] BEIS (2022) British energy security strategy
[98] BEIS (2022) Hydrogen Production Business Model
[99] BEIS (2022) Net Zero Hydrogen Fund strand 1 and strand 2
[100] *The LCHS is currently set at 20g CO_{2e}/MJ LHV of hydrogen produced. This is equivalent to 72g CO_{2e}/$kWh_{(LHV)}$, which is roughly a third of the carbon intensity of natural gas or the current electricity grid, at 237g CO_{2e}/$kWh_{(LHV)}$ and 211g CO_{2e}/kWh respectively. Sources: BEIS (2022) UK Low Carbon Hydrogen Standard: emissions reporting and sustainability criteria and BEIS (2022) Greenhouse gas reporting: conversion factors 2022*
[101] BEIS (2021) Cluster sequencing for carbon capture, usage and storage (CCUS) deployment: Phase-1
[102] BEIS (2022) Proposals for hydrogen transport and storage business models

a willingness to address market barriers to hydrogen transport and storage infrastructure which will be vital for low carbon hydrogen use at scale to become a reality.

HYDROGEN PRODUCTION AND STORAGE DEPLOYMENT

The future deployment of low carbon hydrogen production is currently uncertain due to the nascent nature of the market and ambiguity around cost, consumer preferences and future technologies more broadly. As an example, the National Grid's Future Energy Scenarios 2022, gives a range of potential hydrogen production capacities in 2050 of 26 – 83 GW in their Net Zero Compliant Scenarios.[103]

As funding for low carbon hydrogen has only recently been made available, there are only a couple of hydrogen projects under development in the Solent region. The most advanced of these is a demonstration project with a 35kW electrolyser which will produce hydrogen to be used as a fuel for a harbour boat.[104] Southampton Hydrogen Hub is a larger scale project which has completed a feasibility study. This would be a CCUS-enabled project which could have an initial capacity of approximately 500MW and be online by 2030 provided that it joins the Track-2 clusters in the cluster sequencing process. The project would ship captured CO_2 to an offshore CO_2 storage location. The graphs below show an indicative potential production capacity pathway for hydrogen in the Solent region. This is broadly in line with scaled down national estimates as well as the demand estimated in Southampton Hydrogen Hub's feasibility study. [105]

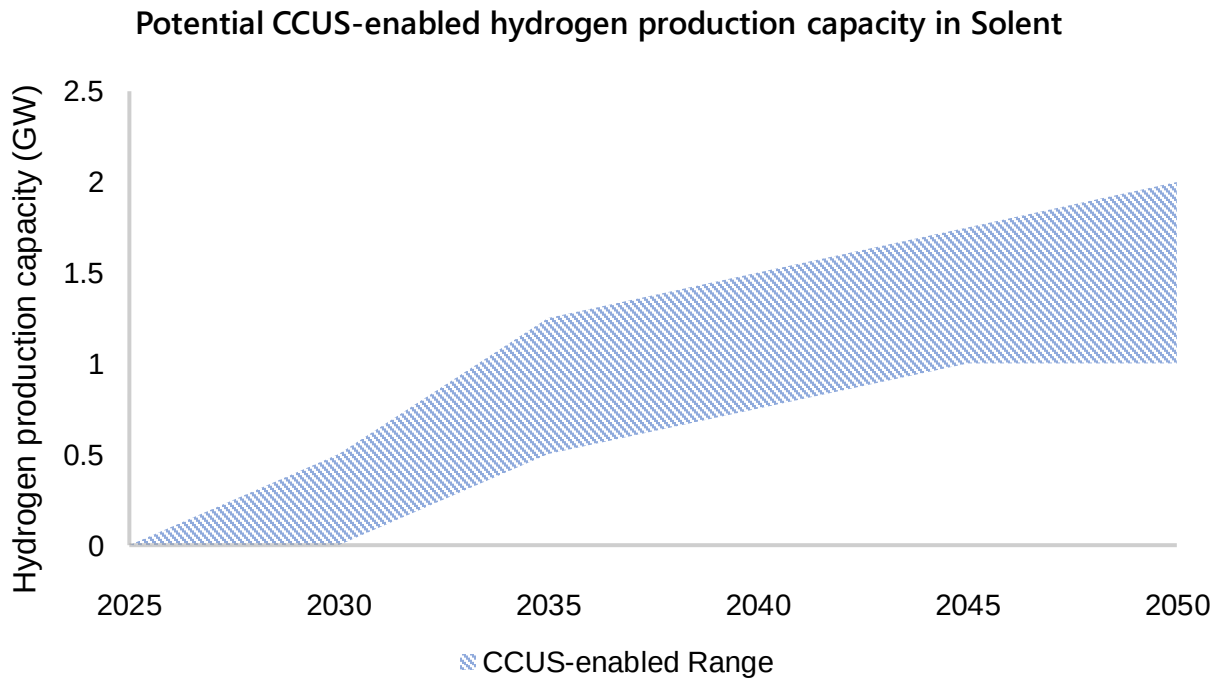

Figure 44 - Indicative Potential CCUS-enabled Hydrogen Production Capacity in Solent 2025 - 2050

[103] National Grid (2022) Future Energy Scenarios
[104] Portsmouth Port (2022) SHAPE UK: SHIPPING, HYDROGEN & PORT ECOSYSTEMS UK
[105] Green Investment Group (2021) ExxonMobil, SGN, and Green Investment Group sign MoU to explore potential for Southampton hydrogen hub

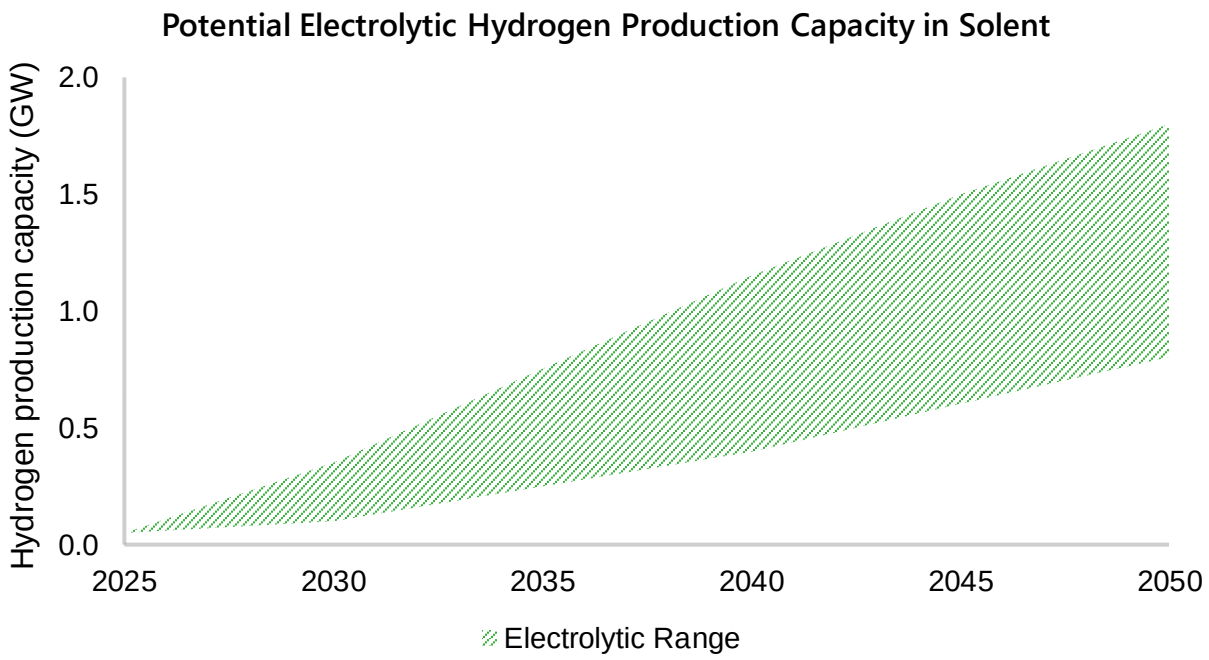

Figure 45 - Indicative Potential Electrolytic Hydrogen Production Capacity in Solent 2025 – 2050

Hydrogen storage will be necessary to balance the variations in supply and demand of hydrogen as well as provide energy security and resilience. Storage requirements are heavily dependent on the type of hydrogen production and demand. If hydrogen is produced using curtailed renewable energy, the production will be very variable and storage requirements will be higher to balance supply and demand. The local storage requirements also depend on how well connected the local production is and will be influenced by whether infrastructure projects such as Project Union[106] go ahead as this could either create a market for local storage or reduce local storage requirements due to resilience being provided by other areas.

Due to the low volumetric density of hydrogen, storage typically requires either high pressure or a change in state of hydrogen. Storage can vary from the kWh scale in pressurised tanks to the TWh scale in underground geological features such as salt caverns or depleted oil or gas reservoirs. The large-scale storage required for the Southampton Hydrogen Hub is likely to be serviced by hydrogen storage with salt cavern storage in the Wessex Basin if local storage is used for the project. UKOG are planning to develop a site which was originally granted planning for natural gas storage in 2008 by Dorset County Council.[107] However, this site and the Wessex Basin more generally, which are shown on the map below, fall outside of the Solent LEP area. According to an assessment by BGS, the Wessex Basin has the largest potential storage of any of region in the UK by a significant margin. For this reason, the region could in theory become an exporter of hydrogen storage, provided hydrogen transmission pipelines are developed.[108] While this activity falls outside the Solent, some of the staff to deliver this infrastructure could come from the region due to the short distance between the regions.

[106] National Grid (2022) Project Union Launch Report
[107] Offshore Energy (2022) UKOG to work on hydrogen-ready energy storage project at Portland Port
[108] Element Energy (2018) Hydrogen Supply Chain Evidence

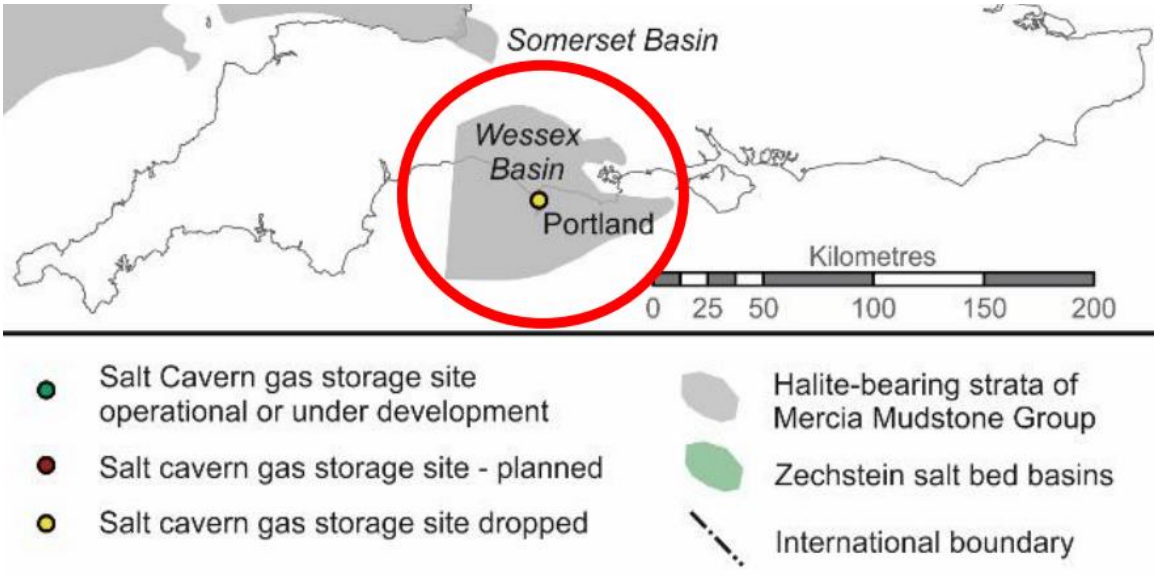

Figure 46 - Map of Geology with Potential Suitability for Geological Hydrogen Storage in South West[109]

In addition to large-scale storage in Dorset, smaller scale storage will be required in the Solent for both electrolytic and CCUS-enabled projects, potentially near demand centres to provide security of supply and react to intra-day variations in demand. This pressurised above ground storage requires a combination of compressors and storage tanks.[110]

SKILLS REQUIREMENTS

Due to the nascent nature of the low carbon hydrogen industry, there is lots of work currently underway which is considering hydrogen skills requirements. As an example of this, Cogent Skills are currently developing the UK's first National Occupational Standards (NOS) for hydrogen production, storage, and transportation[111]. The jobs and skills requirements of different electrolytic and CCUS-enabled projects have been gathered by government as part the electrolytic production allocation round requirements[112] and cluster sequencing process.[113] These contain a wide range of information including job title, activity type, skill level (NVQ), location, whether the job is created, safeguarded or displaced, direct or indirect and salary. This will inform understanding of the jobs and skills requirements of hydrogen production projects.[114]

The skills requirements will depend heavily on the types of technologies deployed and the scale of deployment. However, under any scenario it is likely that most skills in hydrogen production will be in the engineering sector, including chemical, mechanical, electrical, gas and civil engineers.

A report by Element Energy for the Engineering Construction Industry Training Board suggests that electrolytic hydrogen production will have some small skills impacts. Some of the major skills required in installing electrolytic hydrogen production plants are large scale grid connections, as well as connection to water utilities and to hydrogen

[109] Elegancy (2020) Theoretical capacity for underground hydrogen storage in UK salt caverns
[110] Element Energy (2018) Hydrogen Supply Chain Evidence
[111] Cogent Skills (2022) FIRST NATIONAL OCCUPATIONAL STANDARDS FOR HYDROGEN
[112] BEIS (2022) Hydrogen Business Model and Net Zero Hydrogen Fund: Electrolytic Allocation Round 2022: Annex C
[113] BEIS (2022) Cluster sequencing for carbon capture, usage and storage (CCUS) deployment: Phase-2: Annex B
[114] BEIS (2022) Hydrogen sector development action plan

transport infrastructure. The report indicates hydrogen production from reforming natural gas will have lower requirements for training with similar skills requirements to the existing chemical and oil and gas industries. The main focus for upskilling will be in the CO_2 capture, infrastructure and storage. While hydrogen storage could have the highest impact on skills requirements with upskilling required in front end engineering design (FEED), operations and safety.[115] The skills requirements for the production and storage of hydrogen are shown in more detail in Figure 47 below.

Hydrogen technologies

Key technology components	Relevant industries	Time-frame	Skills Impact	Comments on skills and industry similarities
Hydrogen Production – Adv. gas reform	Air separation unit, metallic structures, compressors			Existing skills similar to the chemical and oil and gas industries
Hydrogen Production -Electrolysis	Electrolyser installation, grid connection, AC/ DC substation, compressors			Minor upskilling for commissioning, installation, start-up, and testing of electrolysers
Hydrogen storage	Emptying and processing of salt caverns			Upskilling in FEED, developing technical and safety plans and operative training

CCS technologies

Key technology components	Relevant industries	Time-frame	Skills Impact	Comments on skills and industry similarities
CCS capture plants	Capture plant, compressors, exchange columns, pipework2			Minor upskilling needed for welding, erection, testing and inspection; similar to chem ind.
CO_2 transport infrastructure	Onshore and offshore pipeline laying			Minor technical upskilling for handling of new materials for CO_2 pipelines
CO_2 Storage	Offshore pipeline, injection wells, monitoring			Minor upskilling might be needed for oil and gas personnel in FEED and monitoring stages

Figure 47 - Skills requirements for hydrogen production and storage

In addition to engineering skills, geologists will be necessary for any large-scale geological storage projects. Lots of the skills requirements in the hydrogen sector could be serviced by minor retraining of employees working in the current energy workforce. This is particularly true of CCUS-enabled hydrogen production[116], which is likely to be the dominant production route in in the Solent in the medium term. Many of the supporting roles in a hydrogen economy such as project management, administration, operations & maintenance, health and safety and regulatory could come from other sectors.[116]

[115] ECITB (2020) TOWARDS NET ZERO: The implications of the transition to net zero emissions for the Engineering Construction Industry
[116] BEIS (2021) Green Jobs Taskforce

Analysis has been carried out using ONS input-output tables[117], BEIS data on hydrogen production costs[118], and the potential deployment shown in the section above. This follows a similar approach to analysis carried out by the Hydrogen Taskforce in their assessment of the economic impact of hydrogen deployment.[119]

Table 2 - Estimated job creation from hydrogen production in Solent

	HYDROGEN PRODUCTION DEPLOYMENT		OPERATIONS AND MAINTENANCE	
	EMPLOYMENT YEARS (FTE YRS)	AVERAGE EMPLOYMENT 2025 – 2050 (FTE)	EMPLOYMENT YEARS (FTE YRS)	AVERAGE EMPLOYMENT 2025 – 2050 (FTE)
CCUS-enabled	830 – 1,546	33 - 62	1,596 – 3,548	64 - 142
Electrolytic	383 - 871	15 - 35	2,162 – 5,868	86 - 235

SKILLS PROVISION AND GAPS

Many of the projected jobs involved in hydrogen production and storage deployment will command engineering experience or expertise. These skills requirements are likely to be well serviced by the local colleges and universities in the region. Local colleges offer courses such as general engineering, electrical engineering, and welding.[120] The universities also offer a range of courses including Higher National Certificates (HNC's), Bachelor's degrees, Master's degrees and Postgraduate courses. The courses available at these universities include civil, chemical, electrical, mechanical, and renewable energy engineering. More detail of the courses available can be seen in the Annex. Typically, engineering skills in the Solent are required across all NVQ levels[121], this is likely to also be the case in hydrogen production and storage. While the broad skills requirements are in place there will be a need to be minor adjustments to courses or additional education specifically for working with hydrogen.

There are some general jobs and skills in hydrogen production and storage that can be well serviced by existing professions. An example of this is construction skills which will be required in the deployment of hydrogen production equipment. Construction is a significant sector in the Solent in terms of both employment and contribution to GVA at £2,207 million in 2018.[122] However, more recent evidence suggests skills shortages at all levels in the sector. This, coupled with an ageing workforce and loss in migrant workers since Brexit, highlights the need to increase the number of students receiving training in construction skills.[121] Qualifications in construction skills are offered by local education providers including colleges and universities with 4,179 training or education starts in 2017/18.[122] Project management is another example of a more general skill that will be necessary in hydrogen projects. All three of the local universities offer Master's degrees in project management, with Portsmouth also offering an apprenticeship Bachelor's degree[123].

[117] ONS (2022) UK input-output analytical tables - product by product
[118] BEIS (2021) Hydrogen Production Costs 2021
[119] Hydrogen Taskforce (2020) Economic Impact Assessment Methodology
[120] National Careers Service (2023) Find a Course
[121] Solent LEP (2022) Solent LEP Skills Report
[122] Solent SAP (2020) Local Skills and Labour Market Analysis
[123] UCAS (2023) Course Search

GREEN MARITIME

MARITIME POLICY

UK domestic maritime vessels represented 5% of the UK's domestic GHG emissions in 2020 – more than rail and bus emissions combined.[124] This is one of the sectors where decarbonisation is most challenging, but also most important if the UK wants to meet its climate change targets.

The Government has set a target to reduce GHG emissions from the UK domestic maritime sector to net zero by 2050 at the latest. Their current approach about how best to achieve decarbonisation of the maritime sector is laid out in the UK Domestic Maritime Decarbonisation consultation, released in July 2022. The Net Zero Strategy pathway for UK domestic maritime emissions, shown in Figure 48 below, highlights the necessity for deep cuts in emissions from 2030 onwards, if the UK maritime sector is to attain its net zero goals.[125]

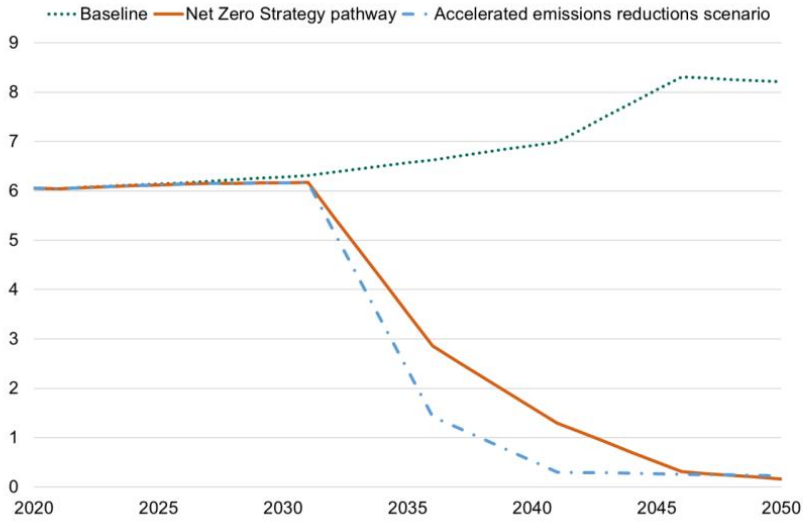

Figure 48 - Estimated greenhouse gas emissions from UK domestic maritime (Mt CO_{2e})[125]

Under the Net Zero Strategy pathway, low carbon fuels (including electricity) are estimated to account for around 42% of total fuel used by the domestic maritime sector in 2035. To reach this point, the UK and the Solent more specifically must have the technology and capacity to deploy low carbon vessels at scale from 2030 onwards.

In order to coordinate the UK's transition to a green maritime future, the Department for Transport set up a new unit after the 2021 Spending Review. The UK Shipping Office for Reducing Emissions (UK SHORE) is tasked with developing clean maritime technologies and creating skilled green jobs across the UK's maritime sector. The new unit was allocated £206 million of initial funding in the Spending Review to accelerate the decarbonisation of the maritime sector. Maritime policy in the Solent is coordinated by Maritime UK Solent, which is a public-private partnership made

[124] DfT (2022) UK Domestic Maritime Decarbonisation Consultation: Plotting the Course to Zero
[125] DfT (2022) UK Domestic Maritime Decarbonisation Consultation: Plotting the Course to Zero

up of key stakeholders in the region's maritime sector. The organisation was set up in September 2019 and is a subsidiary of the LEP.[126]

The national transition to net zero in the maritime sector presents many opportunities for the Solent on a local level. At COP26, the International Maritime Organisation (IMO) launched the Clydebank Declaration for Green Shipping Corridors.[127] This will create routes between two or more ports on which zero-emission shipping solutions are supported. This is an area where the Solent can be a leader in the green maritime field by agreeing to establish green shipping corridors with other international ports. Portsmouth International Port has already set out its ambition to become the first zero emission port in the UK, so this is a potential opportunity to lead the way.[128] By adopting pioneering and innovative new green approaches to shipping, like the Clydebank Green Shipping Corridors, the Solent could stand to benefit from the economic advantages associated with the green maritime transition. Research commissioned by the DfT estimates that the economic benefits to the UK across 11 key maritime emission reduction options could reach $650- 890 million per year by the middle of the century.[129] As it contains one of the UK's leading maritime clusters and three top universities, the Solent is well-positioned to lead the way in developing technological solutions for maritime emissions reduction.

Round 3 of the Clean Maritime Demonstration Competition (CMDC) is allocating £60 million for projects developing clean maritime solutions. The intention of the funding is to help projects develop and test innovative clean maritime solutions. The competition runs from 2023 to 2025 and the ultimate aim is for successful projects to market their technological solutions commercially after the project's completion in 2025.[130] The Solent is a strategically important cluster for maritime innovation, so the CMDC is an important source of funding that private companies, institutions and universities within the region can make use of to fund their research into net zero maritime solutions. The University of Southampton has already received £200,000 of funding via Round 2 of the competition.[131] By making use of the next round of funding, the Solent can make sure it remains at the cutting edge of clean maritime technology.

MARITIME DEPLOYMENT AND ACTIVITY IN SOLENT

Maritime is one of the Solent's core sectors, as it has been throughout the region's history. The region's maritime sector contributes £5.8 billion of GVA each year, equivalent to 19% of the Solent LEP economy.[132] From 2011 – 2021, the Solent has been responsible for approximately 8% of UK's freight volume and 15% of passenger volume, with the latter being up to 17% before the COVID-19 Pandemic.[133] The Port of Southampton is the UK's biggest export port, with over £40bn of UK manufactured goods exported each year – 90% to destinations outside the EU.[134]

[126] Solent LEP (2022) MARITIME UK SOLENT BUSINESS PLAN
[127] DfT (2022) UK Domestic Maritime Decarbonisation Consultation: Plotting the Course to Zero
[128] Solent LEP (2022) Solent 2050
[129] Frontier, E4tech and UMAS (2019) Reducing the Maritime Sector's Contribution to Climate Change and Air Pollution
[130] DfT (2023) Multi-year clean maritime demonstration competition
[131] DfT (2023) Clean maritime demonstration competition (CMDC) winners round 2: strand 1 and strand 2
[132] Solent LEP (2022) SOLENT SKILLS ACTION PLAN & LOCAL SKILLS REPORT
[133] DfT (2022) Maritime and shipping statistics
[134] Solent LEP (2022) Solent 2050: An Economic Strategy for the Solent

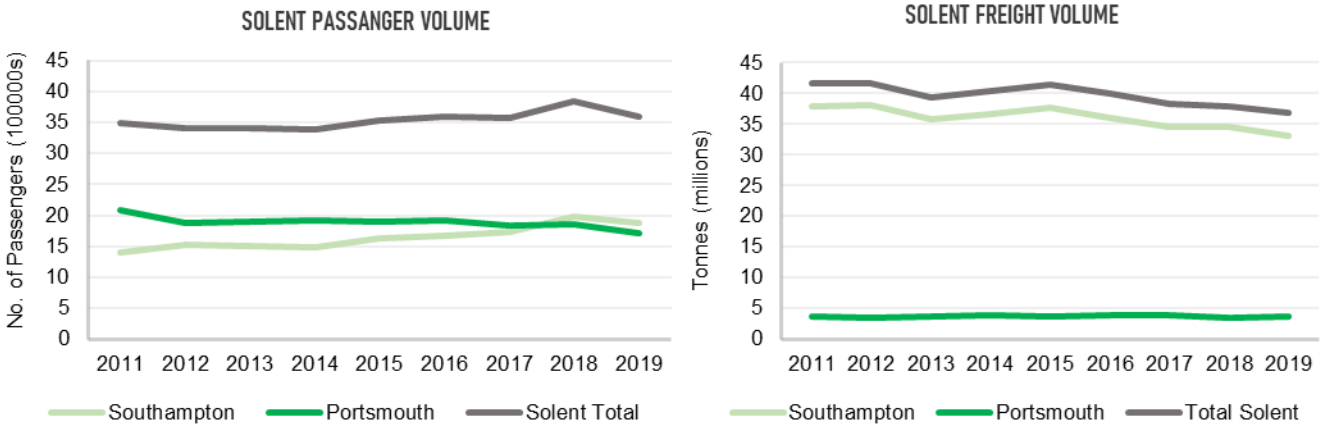

Figure 49- Solent passenger and freight volume 2011-2019

FUTURE OF THE MARITIME SECTOR

The future of the maritime sector and the specific skills requirements will depend to a large extent on the future fuel mix of the shipping fleet. Figures 50 and 51 below map out the expected fuel mix of the Solent shipping industry from 2021 to 2050 in different scenarios. Traditional fuels refer to dense fossil fuels that are currently the dominant fuel source for the global shipping fleet, the most widely used being marine diesel oil.[135] The alternative fuels category covers a range of possible low-carbon propulsion options, including hydrogen-derived fuels and electrical propulsion.

The graph on the left-hand side depicts a "business-as-usual" scenario – based on DNV's forecasts, taking into account historical trends and policy actions. This assumes no significant future interventions that will markedly alter the current trajectory of the sector. Our analysis suggests that in the business-as-usual scenario (BAU), 80% and 29% of the Solent's shipping energy demand is met by traditional fuels in 2030 and 2050 respectively and, alternative fuels make up 5% and 52% in 2030 and 2050.

The right-hand graph describes a Net Zero scenario, which is in line with national and Solent targets to achieve net zero GHG emissions from maritime by 2050. In this scenario, 84% of the demand is met by alternative fuels, while traditional fuels and gas collectively fulfil only 16% of energy demand by 2050. In both scenarios the total energy demand by the shipping sector is projected to grow by 49% from 3.97 TWh in 2021.

[135] DfT (2022) UK Domestic Maritime Decarbonisation Consultation: Plotting the Course to Zero

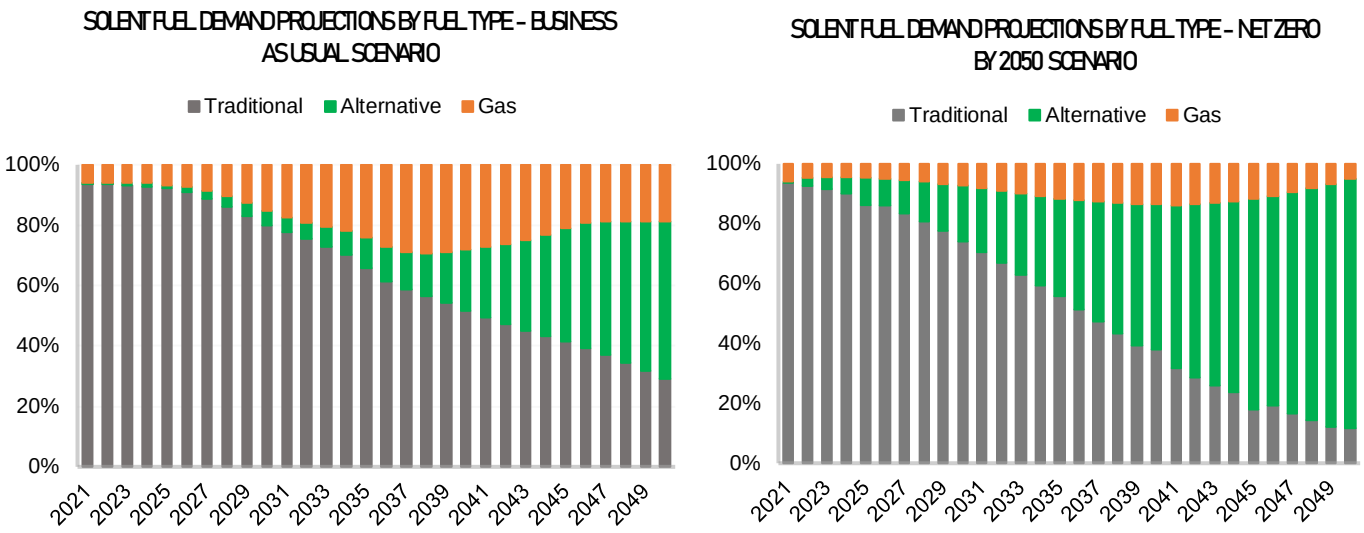

Figure 50 – Maritime fuel demand proportion projections

Figure 51 below sets out in more detail which alternative fuels are expected to dominate the future national shipping fuel mix. The modelling suggests that liquid fuels will remain crucial, with low carbon hydrogen-derived fuels (ammonia and methanol) accounting for the vast majority of demand by 2050. This s primarily due to the fact that ammonia and methanol are estimated to be more cost-effective than using hydrogen as a direct fuel source. Battery-powered electricity is expected to make up only a small proportion of future demand, largely limited to smaller shore craft.[136] Nonetheless, the future fuel mix is uncertain and will depend on a range of factors, such as future technological advances, cost trends, and policy interventions.

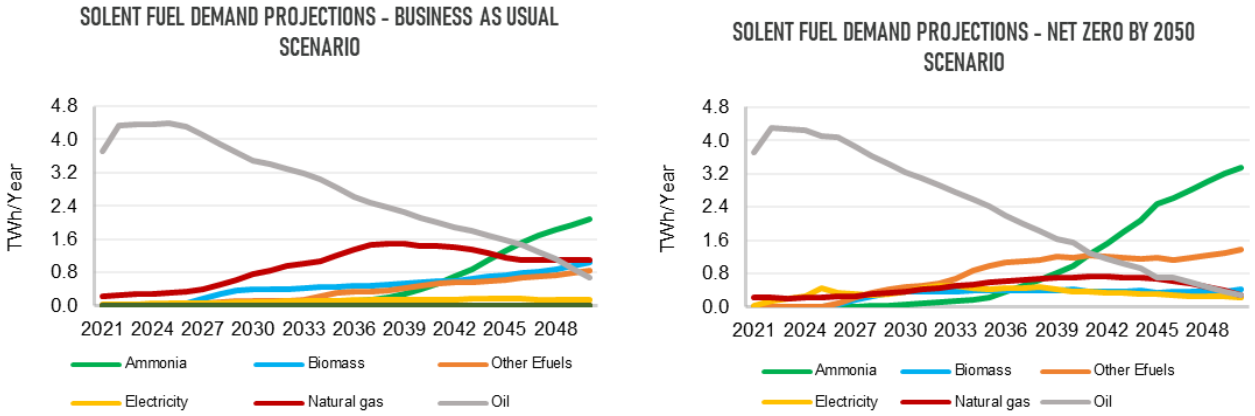

Figure 51– Maritime fuel split projections in the Solent

Considering the central role that hydrogen-based fuels are predicted to play in the Solent's future green maritime sector, a key factor in ensuring a successful transition to green maritime will be enabling the production of a sufficient quantity of low carbon hydrogen.

[136] DfT (2022) UK Domestic Maritime Decarbonisation Consultation: Plotting the Course to Zero

SKILLS REQUIREMENTS

Most of the skills needed to operate low emission craft should be easily transferrable from the existing workforce on traditional vessels. However, there are potential skills and knowledge gaps linked to the handling of these new alternative low emission fuels and technologies. For instance, ammonia-fuelled internal combustion engines, which are projected to be the dominant vessel propulsion technology in a net zero scenario are likely to require aftertreatment systems to deal with the air pollutants emitted. Ammonia combustion produces nitrous oxides (NO_x), so post-combustion treatment will be needed to comply with the IMO's Tier III NO_x requirements[136], which will require training and upskilling.

Upskilling requirements will be even greater when it comes to electrical vessels. Craft operating with electrical battery technology will demand a markedly different skillset to that of marine engineers operating on traditional vessels. Although, the majority of the Solent's future fuel mix is projected to be made up of hydrogen-derived fuels, there will still be a significant minority of vessels with electrical propulsion, especially smaller boats in the leisure sector. As vessels are converted to electric propulsion, there will be numerous supporting jobs, such as service engineers, that need to be upskilled in electrical skills to prepare them for working with electrical systems. Therefore, for seafarers that deal who deal directly with marine fuels, adapting to work with low emission propulsion technologies will represent a significant change compared to their current jobs.

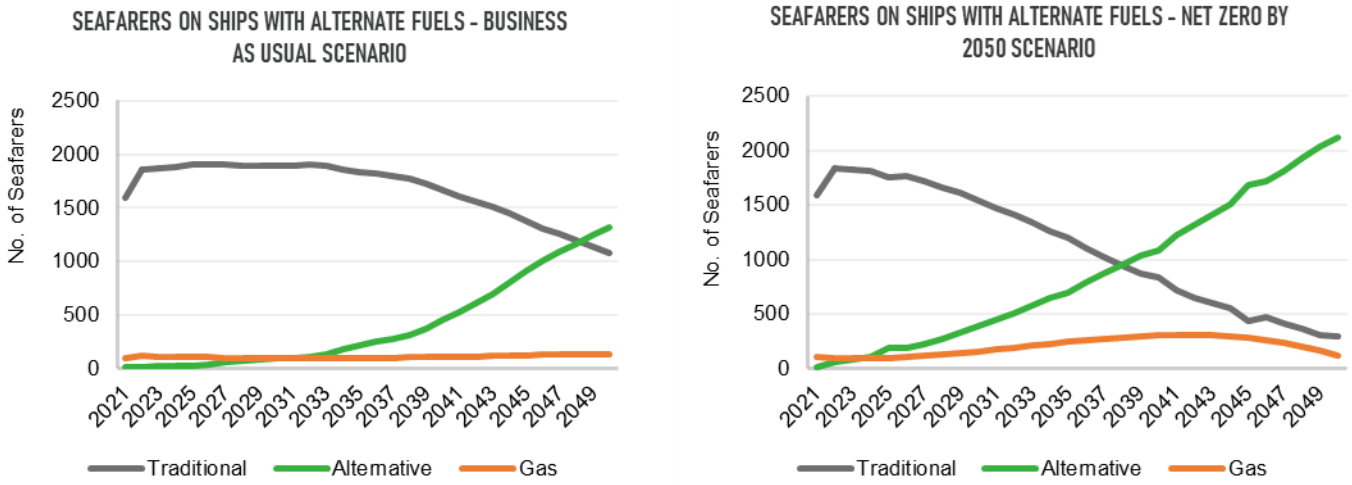

Figure 52 - Seafarers on ships by fuel type projections

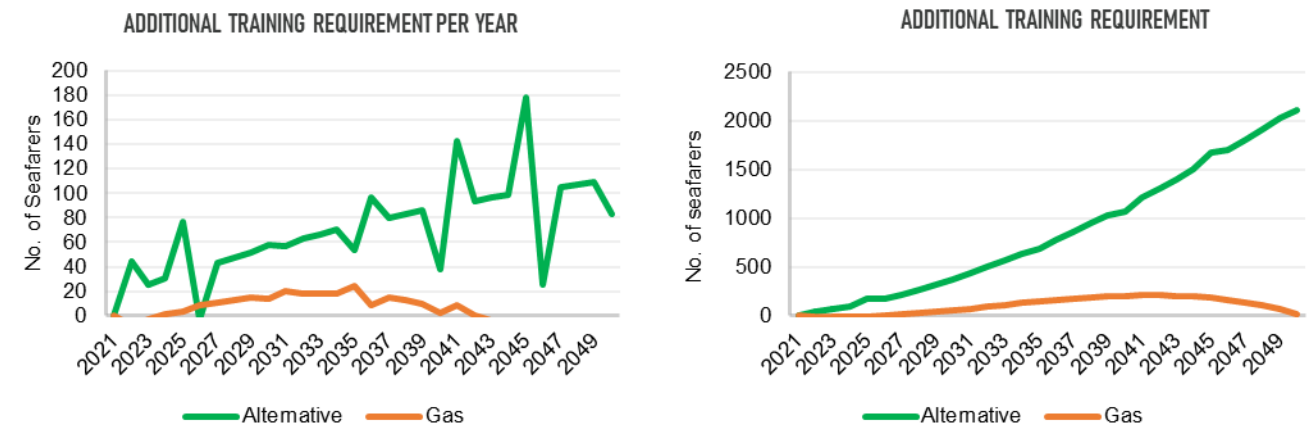

Figure 53- Additional training requirement for net zero by 2050

Currently, the Solent maritime sectors supports 41,500 direct and 113,00 indirect jobs.[137] Our estimates suggest that of these employees, approximately 1,700 seafarers would require additional training to facilitate the transition to net zero by 2050. When an expected 49% increase in total maritime employment is factored in, this number is expected to grow to 2,118 by 2050.

Following the DNVs projections of the global maritime sector, we find that, in the zero carbon by 2050 scenario, 375 seafarers will need additional training to operate on ships with alternative fuels by 2030 and 2,118 by 2050, implying that on average, 73 seafarers need additional training per year.[138]

SKILLS PROVISION AND GAPS

Some of the most important skills needed to facilitate the Solent's transition to green maritime will be in high-skilled areas, such as research and development (R&D), and engineering. Fortunately, the Solent has a strong track record in R&D, with the region ranking 10th out of all LEPs for the percentage of its workforce in R&D related professions.[139] All of the Solent's universities offer a range of engineering and specialist maritime courses, including Higher National Certificates (HNC's), Bachelor's degrees, Master's degrees and Postgraduate degrees. There are a number of world-class institutions in the Solent specialising in maritime education and R&D related to the green maritime transition. These include:

- Southampton Marine and Maritime Institute
- Wolfson Unit of Marine Technology and Industrial Dynamics
- Warsash Maritime Academy
- South Coast Institute of Technology
- Centre of Excellence for Composites, Advanced Manufacturing and Marine (CECAMM)
- Marchwood Construction & Marine Technologies Training Centre
- National Oceanography Centre

As demonstrated by the presence of the leading maritime institutions listed above, there is strong existing provision of maritime training in the region. The Solent is widely recognised as one of the leading clusters for maritime education both nationally and globally. The main challenge is to encourage more new entrants to take up training places and enter the sector.

According to the LEP's Local Skills Report, there are currently significant skills gaps at higher technical levels and in specific sectors, leaving the Solent without the technicians and engineers it needs to build a world-leading green maritime economy.[140] Recent research carried out by the Southampton Marine and Maritime Institute corroborates this picture. In their survey of over 40 marine and maritime firms in the area, over half of respondents cited skills problems as an issue. Most shortages related to engineering and science-based skills.[141] Engineering skills will be

[137] Solent LEP (2022) MARITIME UK SOLENT BUSINESS PLAN
[138] DNV (2022) Insights into seafarer training and skills needed to support a decarbonized shipping industry
[139] Solent LEP (2022) Solent 2050: An Economic Strategy for the Solent
[140] Solent LEP (2022) SOLENT SKILLS ACTION PLAN &LOCAL SKILLS REPORT
[141] SMMI (2021) Future Skills Requirements for a Global Centre of Maritime Training and Education: Skills Challenges for the Solent

essential to the green maritime transition, hence the existing shortage of engineers in the region is currently the biggest skills gap facing the maritime sector as it looks to decarbonise.

Encouraging new entrants into the sector will be necessary both to address these existing shortages and to prevent future ones from emerging. Currently, the maritime industry in the Solent struggles to attract sufficient new entrants to the sector. According to research commissioned by the DfT, concerns around its environmental impacts are one of the main reasons for this. In their survey, climate change was identified by 46% of UK young people as a factor that would prevent them from pursuing or staying in a career in maritime.[142] Decarbonisation of the sector represents an opportunity to change perceptions and attract the highly skilled new entrants the industry needs. There is adequate educational provision at the Solent's universities and specialist maritime institutes, but more work must be done to promote the maritime sector to school leavers.

There is a need to adapt existing training to prepare the workforce for a green maritime future. The Government's Clean Maritime Plan expressed an ambition that by 2025, "all new vessels being ordered for use in UK waters are being designed with zero emission propulsion capability."[142] As deployment of low emission vessels in the Solent increases, it is essential that the level of green maritime skills in the Solent keeps up, so that skills deficits do not become a limiting factor preventing the Solent's maritime sector from achieving decarbonisation. At the moment, there is no legislative framework to put green skills on the maritime training curriculum and there is no capacity to teach learners new green skills in addition to the existing curriculum.[143] As over 99% of current fuel demand is for ships operating on traditional fuels,[144] this remains the priority in terms of maritime education. Significant alterations to the maritime training curriculum will be required to ensure that the Solent's maritime workforce is fully equipped to deal with the changes brought about by the transition to low emission fuels. Taking this action will also help to future-proof jobs in the Solent's maritime sector.

To ensure that the technology and workforce is in place to facilitate the Solent maritime industry's transition to net zero shipping, green maritime skills must become a priority. Urgent action is needed now to upskill the existing workforce with the tools and know-how to handle alternative fuels and operate zero emissions vessels. Investment in higher level skills is also crucial, as high-level R&D will be integral in developing the technological solutions needed to decarbonise the Solent maritime sector.

[142] DfT (2022) UK Domestic Maritime Decarbonisation Consultation: Plotting the Course to Zero
[143] Lars Lippuner (2023) Solent University
[144] International Energy Agency (2022) International Shipping

MARINE CARBON CAPTURE

MARINE CARBON CAPTURE BACKGROUND

Vast amounts of carbon are stored in the UK's seas and coastal habitats, this is known as blue carbon. The UK's shelf seas cover 540,000 km^2. The muddy sediments in this shelf sea (up to 200m) are estimated to store 205 million tonnes of blue carbon[145], 50 million tonnes more than held within the UK's entire stock of standing forests. When saltmarshes and seagrass meadows are included, this rises to 220 million tonnes.[146] The most significant blue carbon sinks in the UK are:

- Saltmarshes and tidal mudflats
- Sea sediments
- Seagrass beds
- Kelp and other seaweeds

Scientists estimate saltmarsh and seagrass habitats sequester carbon at 2-4 times the rate of mature tropical forests, meaning the UK's entire stock of saltmarshes and seagrass beds have the carbon storage potential of between 1,000 - 2,000 km^2 of tropical forests.[147] The Solent's marine and coastal habitats are a blue carbon sink of regional and national significance. Hence, it is vital for the region's net zero ambitions that its natural capital is properly protected, as one of the Solent's most important climate mitigation assets.

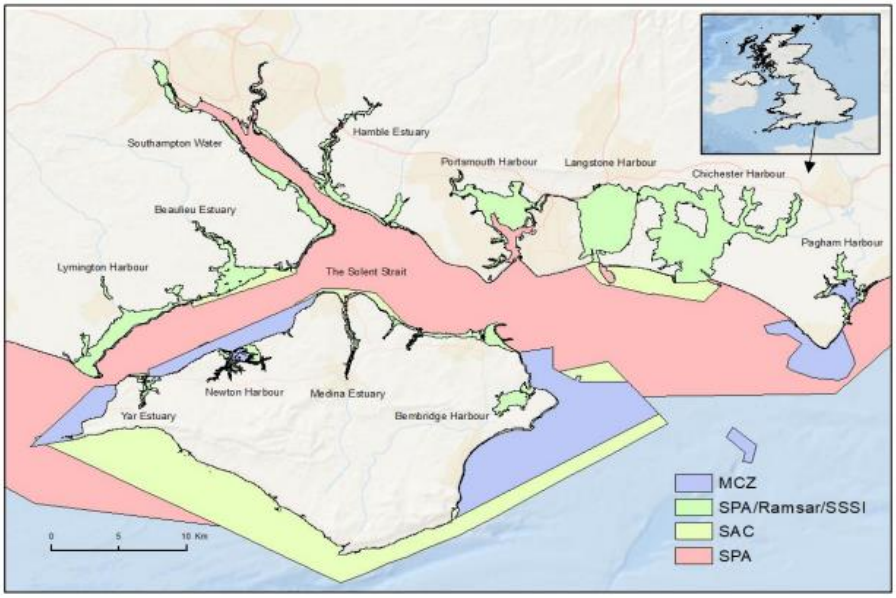

Figure 54 - Designated marine and intertidal conservation sites in Solent (Jan 2020)

As the map above shows[148], most of the Solent marine and coastal area is already classified as a Marine Protected Area (MPA), thus giving it some kind of theoretical protection. Marine Protected Area (MPA) is an umbrella term which describes parts of the ocean that are protected by either voluntary agreements or national law to conserve the species, habitats and ecosystems within. However, the level of protection and enforcement can vary markedly across MPAs. There

[145] MCS (2021) Blue carbon Ocean-based solutions to fight the climate crisis
[146] IUCN UK Committee (2009) Peatlands and Climate Change
[147] The Blue Carbon Initiative (not dated) What is Blue Carbon?
[148] University of Portsmouth (2020) Valuing the Solent Marine Sites Habitats and Species

are fully protected areas (also called no-take zones), highly protected areas, lightly protected areas and minimally protected areas.[149]

Data gathered by Global Fishing Watch and the Marine Conservation Society found that bottom trawling and dredging are taking place in 98% of the UK's offshore MPAs.[150] This can have damaging impacts on the seabed, which is the planet's biggest source of organic carbon.[151] By disturbing sediments on the seabed, these activities re-suspend carbon in the water, reducing the ocean's capacity to absorb excess CO_2, and releasing captured carbon back into the atmosphere as CO_2.[152] Therefore, it is important that the LEP, LAs, maritime authorities and other local stakeholders collaborate to tighten protections and improve enforcement activities. This would not have to cover the entire Solent maritime area but could be introduced first in areas of particular importance for carbon capture, such as the seagrass meadows off the Yarmouth coast. Protections do not need to stop fishing all together, however they should limit some of the most harmful practices, such as dredging and bottom trawling. Case studies from other regions show that restoring marine habitats has positive impacts on the fish stocks and could significantly benefit the fishing industry in the long run. For example, in Lyme Bay, scallop landing doubled and brown crab catches rose by 2.5 times following the introduction of certain protections.[151]

Progress should not be limited to protecting oceans. The impact of water pollution can also have a significant impact on marine habitats and limit their ability to sequester carbon. Water pollution can arise from a number of sources including agriculture, coastal development and dumping of sewage. These activities do not need to stop for impacts to be mitigated but the way in which we approach agriculture, coastal development and dumping of sewage does need to change. Regenerative farming is an example of utilising innovative approaches that result in less harm to both the land and sea due to the reduction in soil erosion and reduced fertiliser runoff which is harmful for the local waterways.

Engaging with local stakeholders will be vital for progress to be made. This should include highlighting the importance of the marine habitats in the Solent as well as communicating the benefits of more sustainable practices such as increased fishing stocks and agricultural productivity that can arise when more sustainable practices are used.

[149] Fair Seas (2022) SAC, SPA, MPA… so what do they all mean?
[150] MCS (2021) Marine Unprotected Areas
[151] MCS (2021) Blue carbon Ocean-based solutions to fight the climate crisis
[152] Luisetti et al (2019) Quantifying and valuing carbon flows and stores in coastal and shelf ecosystems in the UK

MARINE CARBON CAPTURE ACTIVITY IN SOLENT

The Solent Seascape project is a $5 million, 5-year project which is the first of its kind aiming to restore seascape scale recovery. This project aims to:

1. Work with local stakeholders and communities to develop and co-create a long-term seascape recovery plan, that supports better management of existing Solent marine and coastal habitats.
2. Actively restore 8 ha of saltmarsh, 7 ha of seagrass, 4 ha of oyster habitat, and 10 breeding seabird nesting sites to increase habitat extent and catalyse recovery across the wider seascape, improving ecological connectivity.
3. Assess ecosystem service benefits (carbon, biodiversity, nitrates), creating an evidence base of the wider benefits of seascape restoration.
4. Work with government and regulators to develop key interventions and financial mechanisms to upscale the potential for seascape restoration in the longer term.
5. Empower local communities and build capacity to ignite and improve understanding of seascape processes, catalyse behavioural change, and increase involvement in seascape recovery[153].

England's biggest ever seagrass regeneration project - LIFE ReMEDIES - began in 2020 and is aiming to regenerate seagrass meadows, which are vitally important blue carbon sinks, in five Special Areas of Conservation (SACs) across the south of England.[154] The Solent SAC is home to 15 hectares of seagrass meadow, but it is in a poor state. The ReMEDIES project plans to plant 4 ha of seagrass meadows in the Solent Maritime SAC to help restore this important blue carbon sink. As part of the project, engineers have been developing and trialling advanced mooring systems (AMS) because traditional boat moorings like long chain anchors can destroy seagrass meadows.[155] Four AMS were installed in Yarmouth Harbour in 2020 and 2021, and after monitoring their performance, the harbour is keen to install more AMS and are also interested in trialling their own design.[156] This project provides an excellent model for how to protect vital blue carbon sinks and reduce carbon emissions through a combination of conservation and innovation.

SKILLS REQUIREMENTS

While the importance of the oceans in sequestering carbon is accepted, there is still a significant amount of research required to understand the scale of habitat loss and the impacts of restoring these. Future research should build upon work already being undertaken by the region's universities such as the Solent Seascape project being carried out by Portsmouth University. The local universities provide a broad range of courses that will be vital in providing the necessary skills to maximise the carbon sequestration of the Solent area. These include marine biology, marine environmental science, oceanography, geography, and social science courses. The three universities in the Solent provide a wide range of courses on these topics that give the region a competitive advantage in marine carbon capture skills.

As research continues and understanding of the ecosystems develops, attention will be turned to implementing natural solutions. This could include activities such as planting seagrass or installing biodegradable groins which will increase

[153] Blue Marine Foundation (2023) Restoring the Solent's Seascape: for people, nature, and climate
[154] ReMedies (2022) England's largest ever seagrass planting hits new milestone
[155] ReMEDIES (not dated) Blue carbon
[156] ReMEDIES (not dated) Project overview

the coverage of important habitats and increase the carbon sequestration ability of the region as well as providing benefits for biodiversity and fish stocks. Implementing solutions will require additional skillsets such as divers to actively plant and monitor seagrass.

While it is too early for accurate future employment estimates due to uncertainty about the size of different habitats and labour intensity in restoring these, a local expert suggested that restoring habitats in the Solent could easily employ between 50 and 100 workers at any one time.

Skills should not be limited to restoration work but should prevent further damage to the ecosystems in the Solent. As an example of this, the local marine workforce and boat operators could be better educated in sustainable practices to limit further damage to the region's blue carbon reserves. This could include training all local seafarers in minimising the impact of anchoring boats in the region. In addition to more sustainable mooring practices, engineers have developed advanced mooring systems that preserve the seabed by suspending moorings across the seafloor. These have a much lower impact on the seabed than traditional boat mooring, which can destroy seagrass meadows.[157]

Solent LEP could play a role in bringing together stakeholders such as researchers to establish skills requirements and ensure that training is adequate. It could also play a convening role between stakeholder groups whose practices damage the local marine habitats, such as farmers and property developers, and researchers to enable collaboration and more sustainable practices to be used in future.

[157] RYA (2021) The Green Guide to Anchoring and Moorings

CONCLUSIONS AND RECOMMENDATIONS

There are significant opportunities for the Solent region to capitalise on during the decarbonisation process for the sectors investigated in this report. However, given the nascent nature of some of the sectors investigated, such as low carbon aviation, hydrogen production and storage, green maritime and marine carbon capture, continued assessment will be required to ensure skills in the region are adequate. In some cases, large scale deployment depends on national policy and government funding, such as Southampton Hydrogen Hub awaiting the Track-2 cluster sequencing decision. There are certain actions that can be taken by Solent LEP to support the acceleration of low carbon skills in the region, some of these options are listed below:

SUPPORT SECTORS TO JOIN THE DOTS BETWEEN SUPPLY AND DEMAND

- Play a convening role and support industry to identify potential opportunities for decarbonisation. As an example, the LEP could host workshops or events on hydrogen and hydrogen-based fuels. This should connect hydrogen production, midstream and end use and could include participants from local industrial firms, businesses involved in converting hydrogen into hydrogen carriers, ports, Southampton Airport, as well as any other potential users.

COMMUNICATE EMPLOYMENT OPPORTUNITIES AND SIGNPOST SKILLS REQUIREMENTS

- Encourage collaboration between industry and education providers to enable future training provision to be tailored to meet industry needs and sector specific demands.
- Engage with STEM fairs to ensure graduates at the universities in the area are aware of the local need for these skills.

CO-ORDINATE INDUSTRY AND EDUCATION PROVIDERS TO DELIVER SKILLS REQUIREMENTS

- Co-ordinate industrial representatives with similar skills needs in the region. As an example, there is likely to be a high demand for electrical skills in Solent due to the electrification of heat and transport, as well as electrical skills being required for electrolytic hydrogen. Identifying cross-sector requirements may support education providers in developing modules to cover core skills which could be common to different sectors.
- Develop and grow structured partnerships between industry, education, and training providers at all levels, to reflect the requirements of the low carbon sector. This could include:
    - Sector-based work academies that focus on the skills requirements to deliver decarbonisation such as electrical and engineering skills.
    - Supporting re-training of employees, particularly where base skills already exist, and identifying which sectors can easily retrain to low carbon jobs.

DEVELOP INFORMATION CAMPAIGNS

- Produce information campaigns to highlight to school leavers and retraining workers the employment opportunities presented by the shift to low carbon technologies.
- Work with industry to encourage the development of education packs to be used in primary and secondary school lessons on climate change. These could be sector specific (e.g. low carbon transport) and targeted towards individual year groups.

- Develop information campaigns targeted towards regional businesses, outlining the support packages available within the region.

PROVIDE FUNDING TO SUBSIDISE TRAINING FOR LOW CARBON SKILLS

- Funding should be provided to support adult training for the most in-demand low carbon skills. This could include fixed amounts of financial support for skills training in sectors identified as having the most significant skills gaps such as:
    - Electric vehicle charging infrastructure
    - Insulation retrofit
    - Heat pump installation
- The LEP should encourage and help local employers and training providers to apply for national training funding, via schemes such as the Adult Education Budget and Strategic Development Fund. LAs should apply for national apprenticeship funding on behalf of local schools to improve apprenticeship opportunities for students and school leavers.[158]

ADVOCATE FOR ACCELERATED NATIONAL GOVERNMERNT FUNDING AND REGULATION

- Support Southampton Hydrogen Hub in its applications to receive Track-2 funding as part of the cluster sequencing process. This could include advocating for accelerated timeframes for decision making by highlighting the size of the opportunity for hydrogen and hydrogen-based fuels in the area.
- Advocate for a 'Green Skills Fund' to ensure green skills become an integral and integrated part of training programmes.

WORK WITH LAs TO UTILISE PLANNING POWERS MORE AMBITIOUSLY TO SUPPORT A NET ZERO CONSTRUCTION SKILLS STRATEGY

- This could include setting higher energy efficiency standards for new developments to minimise the energy efficiency upgrades needed for new housing and to incentivise the development of low energy construction skills.
- Southampton City Council has already used its devolved powers to set higher energy efficiency standards for new developments.[159] The LEP and other LAs should look to replicate this across the Solent.

SUPPORT CROSS-SECTORAL COLLABORATION BETWEEN THE HYDROGEN AND GREEN MARITIME SECTORS

- Our analysis highlights the likelihood that green maritime in the Solent will be dominated by hydrogen-based fuels. Solent LEP could play a role in supporting cross sector collaboration through initiatives such as bringing together hydrogen producers with developers of advanced fuels and end users.

[158] Department for Communities and Local Government (2017) Apprenticeship reforms: guide for local authorities
[159] Hampshire County Council (2022) Briefing 4: Skills deficits in construction and the policies to address them

ANNEX

ANNEX 1: SUMMARY OF STAKEHOLDERS AND RESEARCH METHODS

TABLE OF RECOMMENDATIONS MADE BY THE 'REVIEW OF NET ZERO[160]

Table 4 - Table of recommendations made by the Review of Net Zero

Area	Timing	Recommendation
Skills	2023	Government should drive forward delivery of the recommendations of the Green Jobs Taskforce and the commitments from the Net Zero Strategy. Government to publish an action plan for net zero skills that includes a comprehensive roadmap of when, where, and in which sectors there will be skills needs specific to net zero. Government should look to report on progress made to delivering the recommendations on a regular basis, starting by mid-2023.
Skills	2023	To monitor progress against the just transition, Government should swiftly develop robust regional green jobs statistics (ideally at local authority level, at least for England), breakdowns of green jobs considering protected characteristics, and publish information about salary levels.
Skills	2023	Government and the Green Jobs Delivery Group should explore a variety of targeted options, including: Increasing the flexibility of the Apprenticeship Levy, and assessing whether the Levy aligns with Government net zero and growth priorities, whether shorter, more intensive courses should be available alongside exploring the role of T levels Options for retaining talent within businesses and access to international labour
Strong Delivery and Governance	2023	Government to establish an 'Office for Net Zero Delivery' by Spring 2023, to ensure that the cross-departmental priorities for net zero are properly managed.
Energy Efficiency	2025	Legislate by 2025 the minimum energy efficiency rating to EPC B for all non-domestic buildings, both rented and owned, by 2030. Legislate for EPC B rating for all new non-domestic buildings from 2025.
Energy Efficiency	2025	Government should regulate through a suite of measures to create the conditions for sustained growth of new markets for low-carbon heat, so that at least 600,000 heat pumps are installed each year by 2028, and up to 1.9 million by 2033. The Government should implement the off- gas grid regulations that envisage the end of new and replacement fossil fuel heating systems in the mid-2020s.
Energy Efficiency	2023	Government should bring forward all consultations and work to mandate the Future Homes Standards by 2025 to prevent further delays by ensuring the standard applies to all developments. This should include a consultation on mandating new homes to be built with solar and deliver the Net Zero Homes Standard, ensuring that the planning system is flexible enough to enable this.

[160] MISSION ZERO - Independent Review of Net Zero (publishing.service.gov.uk)

Energy Efficiency	2025	Government should support establishing retrofit hubs by 2025 to bridge the gap between households and suppliers. These could enable installers to seek training and impartial advice and could connect households to suitable installers.
Energy Efficiency	2024	Government should provide certainty by 2024 on the new and replacement gas boiler phase out date. The Review recommends bringing the proposed date of 2035 forward and legislating for 2033. Government should legislate for all homes sold by 2033 to also have an EPC rating of C or above, with exclusions around certain properties (e.g. listed properties, on grounds of affordability). Government should also mandate landlords to include 'average bill cost' alongside the EPC (and possible future NZPC) rating, when letting a property out. This will help renters understand what costs to expect, while also helping to put a premium on energy efficient homes.
Energy Efficiency	2023	Government should consider options to support homes to include roof solar panels installation as part of its retrofit provision to support homes reaching the Net Zero Homes Standard.
Energy Efficiency	2028	Government should deliver the Heat Pump Investment Accelerator to catalyse private investment for at least two major heat pump factories in the UK.
Energy Efficiency	2028	Government should extend the Boiler Upgrade Scheme to 2028 and consider whether grant levels should be increased in light of inflationary pressures. This should happen alongside efforts to increase awareness of government support. Support for those unable to afford the upfront costs associated with improving energy efficiency and moving to low carbon heating systems should be continued and expanded, namely through the Home Upgrade Grant (HUG), Social Housing Decarbonisation Fund (SHDF) and other existing schemes for low-income households.
Energy Efficiency	2028	Government should set the policy framework and supportive investment environment to encourage reskilling and greater training opportunities in the heat pump sector and work to encourage adoption of standards to increase firms able to take up existing schemes.
Energy Efficiency	2023	Government should choose from multiple options which could help increase heat pump efficiency: 1. Suppliers say this could be done via a mandate stating the minimum efficiency which needs to be achieved by all installations. Government should test whether this could be done by most major installers for most properties. 2. Set up a heat pump coefficient of performance competition, run for example by the Energy Efficiency taskforce. This will show the state of the art technologies with higher efficiencies and allow others to replicate these. Quality of the installation matters; training and installation standards need to be accelerated to support this.

ANNEX 2: LIST OF COURSES IN THE SOLENT

INSULATION RETROFIT AND LOW CARBON HEATING

COURSE	TECHNOLOGY	LEVEL	OFQUAL	TRAINING CENTRE	ACCREDITATION
LCL Awards level 3 in Installation and Maintenance of Heat Pump Systems (non-refrigerant circuits) - New[161]	Heat Pumps	LCL Awards Level 3 Award	Yes	• Business Edge Ltd (Portsmouth), 6 Dragoon House, Westside View, Waterlooville, Hampshire, PO7 7SF • Hampshire Training & Assessments Ltd, Unit 1-3 Solent Building Southmoor Lane Havant Hampshire PO9 1JW	• MCS • CPS
BPEC Heat pump system (NOS mapped) Heat Pump Technology Air Source / Heat Pump Technology Ground Source[162]	Heat Pumps	BPEC	No	• Business Edge Ltd, 6 Dragoon House, Hussar Court, Westwide View, Waterlooville PO7 7SF • SERT Training SERT at GFM, Brune Park School 1 Military Road Gosport Hampshire PO12 3BX	• MCS • CPS
Level 3 NVQ Dip in Domestic Plumbing & Heating 600/6863/2 - EN2 (Heat Pumps)[163]	Heat pumps	Level 3 NVQ diploma		Not currently available in the South West	• MCS • CPS
LCL level 3 award in the Installation and Maintenance of Heat Pump Systems (Non-refrigerant Circuits)[164]	Heat Pumps	LCL Level 3 Award	Yes	• Hampshire Training & Assessments Ltd, Unit 1-3 Solent Building Southmoor Lane Havant Hampshire PO9 1JW • Business Edge Ltd (Portsmouth) 6 Dragoon House Westside View Waterlooville Hampshire PO7 7SF	• MCS • CPS
OFTEC Installation, commissioning and servicing of ground source heat pumps (OFT21-504G)[165]	Heat pumps	OFTEC		• SERT Training SERT at GFM, Brune Park School 1 Military Road Gosport Hampshire PO12 3BX	• MCS • CPS
OFTEC Installation, commissioning and servicing of air source heat pumps (OFT21-504A)[166]	Heat pumps	OFTEC		Not available in the Solent	• MCS • CPS

[161] Level 3 Award in the Installation and Maintenance of Heat Pump Systems (Non-refrigerant Circuits)
[162] https://bpec.org.uk/qualification/heat-pump-systems/
[163] https://bpec.org.uk/qualification/dip-plumb-heat-et/
[164] https://eal.org.uk/quals-finder/qualifications/2656-level-3-award-in-the-installation-and-maintenance-of-heat-pump-systems-non-refrigerant-circuits
[165] https://www.oftec.org/technicians/industry-training/training-courses-assessments/oft21-504g-installation-commissioning-and-servicing-of-ground-source-heat-pumps
[166] https://www.oftec.org/technicians/industry-training/training-courses-assessments/oft21-504a-installation-commissioning-and-servicing-of-air-source-heat-pumps

Refrigeration air conditioning and heat pump engineering technician (level 3)[167]	Heat Pumps	Apprenticeship Level 3 NVQ	Yes	Not available in the Solent	• MCS • CPS
Heat pumps[168]	Heat pumps	NICEIC (Level NA)		Not currently available in the South West	• MCS • CPS
Apprenticeship Commercial thermal insulation operative[169]	Insulation	Apprenticeship Level 2 NVQ		Not available in the Solent	
Level 3 NVQ Diploma in Domestic Plumbing and Heating (6189-31) (600/1122/1) Heat pumps pathway [170]	Heat pumps	Apprenticeships City and Guilds level 3		Various, but unclear whether the heat pump pathway is offered.	• MCS • CPS
City and Guilds Level 2 NVQ in Insulation and Building Treatments (Construction)[171]	Insulation	City and Guilds Level 2 NVQ	No	Not offered in the South West	• CPS • PAS:2030
City and Guilds Level 3 NVQ in Insulation and Building Treatments (Construction)[172]	Insulation	City and Guilds Level 3 NVQ	No	Not offered in the South West	• PAS:2030 • CPS
LCL Gas Safety for Cavity Wall & Loft Insulation Installers[173]	Insulation	LCL		Not offered in the South West	• PAS:2030
NOCN Level 2 Diploma in Cladding Operations [174]	Insulation	NOCN Level 2		Not offered in the South West	• PAS:2030
GQA Level 2 in Cladding Operations[175]	Insulation	GQA Level 2		Not offered in the South West	• PAS:2030
GQA Level 3 in Cladding Operations[176]	Insulation	Level 3		Not offered in the South West	• PAS:2030

[167] https://www.bathcollege.ac.uk/course/view/2253/refrigeration-air-conditioning-and-heat-pump-engineering-technician-level-3-refrigeration-22-23
[168] https://www.niceic.com/contractor/training-courses/renewables-courses/heat-pumps
[169] https://www.findapprenticeship.service.gov.uk/apprenticeship/1000127098
[170] https://www.cityandguilds.com/qualifications-and-apprenticeships/building-services-industry/plumbing/9189-plumbing-and-domestic-heating#tab=documents
[171] https://www.cityandguilds.com/qualifications-and-apprenticeships/construction/construction/5931-insulation-and-building-treatments#tab=information
[172] https://www.cityandguilds.com/qualifications-and-apprenticeships/construction/construction/5931-insulation-and-building-treatments#tab=information
[173] https://lclawards.co.uk/qualifications/lcl/gas-safety-for-cavity-wall-loft-insulation-installers/
[174] https://www.nocn.org.uk/products/qualifications/18495-603-2355-3-nocn_cskills-awards-level-2-nvq-diploma-in-cladding-occupations-construction/
[175] https://gqaqualifications.com/qualification/gqa-level-2-nvq-diploma-in-cladding-occupations-construction/
[176] https://gqaqualifications.com/qualification/gqa-level-3-nvq-diploma-in-cladding-occupations-construction/

GQA Level 2 Diploma in fenestration installation[177]	Double glazing	Level 2		Not available in the Solent	• MCS
Level 2 Award – Understanding Domestic Retrofit[178]	Trades working in retrofit	Level 2	Yes	• Available online as an e-learning course. • City College Plymouth (until 17 March 2023).	• MCS • PAS:2030 • PAS:2035 • TrustMark
Level 3 Award- in Domestic Retrofit Advice[179]	Retrofit advisor	Level 3		• Available online as an e-learning course free for people in Bath and Bristol • Paid for at cost for the rest of the region	• MCS • PAS:2030 • PAS:2035 • TrustMark
Level 4: Award in Domestic Retrofit Assessment[180]	Retrofit assessor	Level 4	Yes	• Available online as an e-learning course free for people in Bath and Bristol • Paid for at cost for the rest of the region	• MCS • PAS:2030 • PAS:2035 • TrustMark
Level 5: Diploma in Retrofit Coordination & Risk Management[181]	Retrofit coordinator	Level 5	Yes	• Available online as an e-learning course free for people in Bath and Bristol • Paid for at cost for the rest of the region	• MCS • PAS:2030 • PAS:2035 • TrustMark
Elmhurst retrofit assessor (for Domestic energy assessors)[182]	Retrofit assessor	NA		• Available online • Not currently available in person in the South West	• PAS:2035

HIGHER EDUCATION COURSES

COURSE	PORTSMOUTH UNIVERSITY	SOLENT UNIVERSITY	UNIVERSITY OF SOUTHAMPTON	SECTORS
Civil Engineering	- Civil Engineering Degree Apprenticeship (Beng) - Civil Engineering (Beng/Meng/MSc)	- Civil Engineering (HNC)	- Civil Engineering (Beng/Meng/MSc)	Hydrogen
Chemical Engineering			- Chemical Engineering (Beng/Meng) - Advanced Chemical Engineering (MSc)	Hydrogen Green Maritime
Electrical / Electronic Engineering	- Electrical and Electronic Engineering (HNC)	- Electronic Engineering (Beng)	- Electrical and Electronic Engineering (Beng/Meng)	Hydrogen Transport and logistics

[177] https://gqaqualifications.com/qualification/gqa-level-2-nvq-diploma-in-fenestration-installation/
[178] https://retrofitacademy.org/level-2-award-udr/
[179] https://retrofitacademy.org/level-3-award-in-domestic-retrofit-advice/
[180] https://retrofitacademy.org/level-4-domestic-retrofit-assessment/
[181] https://retrofitacademy.org/l5-methods-of-study/
[182] https://www.elmhurstenergy.co.uk/retrofit-assessor-training/

	- Electronic Engineering (Beng/Meng/Mphil/PhD) - Electronic and Electrical Engineering (MSc)		- Electrical Engineering (Beng/Meng) - Electronic Engineering (Beng/Meng)	Green Maritime
Mechanical Engineering	- Mechanical Engineering (HHC/BEng/Meng/MSc)	- Mechanical Engineering (BEng)	- Mechanical Engineering (BEng/MEng) - Mechanical Engineering/Sustainable Energy Systems (MEng)	Hydrogen
Project Management	- Project Management Degree Apprenticeship (BSc) - Engineering Project Management (BSc/MSc) - Construction Project Management (MSc) - Project Management (MSc)	- Project Management (MSc)	- Project Management (MSc)	Hydrogen Transport and logistics Green maritime
Renewable Energy Engineering	Renewable Energy Engineering (BEng/Meng)	Renewable Energy Engineering (BEng)		Hydrogen Transport and logistics

ANNEX 3: ANALYSIS METHODOLOGY, ASSUMPTIONS AND OTHER INFORMATION

Technologies in scope

We have focused our analysis on a selection of measures across both insulation and low carbon heating. For insulation, the measures within scope have been included as they are the most widespread and cost-effective solutions and offer the potential for vast energy consumption reductions across the building stock. The technologies included and assumptions around when required are detailed below:

Table 5 - Insulation measures included

MEASURE	DESCRIPTION	INSTALLATION REQUIRED ASSUMPTION	
		Domestic	Non-domestic
Cavity wall insulation	Insulation in the wall cavity of properties with cavity walls.	Installed in cavity walled properties with either no insulation or thermal transmittance greater than 0.55 W/m2k from the property's walls.	EPC recommendation
Solid wall insulation	External or internal wall insulation for properties with solid walls.	Installed in solid walled properties with no wall insulation.	EPC recommendation
Loft insulation	Insulation rolled out over floor joists in loft to prevent heat loss from roof.	installed in all properties that are not maisonettes or flats with no loft insulation, loft insulation thickness below 100mm or roof thermal transmittance above 0.18W/m2k.	EPC recommendation
Double glazing	Two panes of glass installed in a pane separated by a vacuum.	Installed in properties with an EPC windows energy rating of "very poor", 0% of windows double glazed and available for window renovation (i.e not a listed or protected building).	EPC recommendation

For low carbon heating, our analysis predominantly focuses on the need for air source heat pumps, ground source heat pumps, heat networks and heating controls. These technologies were seen as the low carbon heating systems with the most widespread technical and economic feasibility within the scenario timescales. The chosen measures offer low carbon solutions to a wide range of properties, allowing the scenarios to have widespread applicability. The low carbon heating measures chosen were:

Table 6 - Low carbon heating measures included

MEASURE	DESCRIPTION	INSTALLATION REQUIRED ASSUMPTION
Air source heat pump	Suitable for most properties given that there is sufficient space and ventilation as well as no significant noise constraints.	Home has a fossil fuel heating system that requires replacing and not suitable for conversion to heat network. ASHP to GSHP Split taken from current deployment by local authority and split by domestic and non-domestic.
Ground source heat pump	For larger properties and those unable to fully insulate, potentially due to being listed or facing restrictive planning permissions, however, require large amounts of space so more suitable for larger off grid homes.	Home has a fossil fuel heating system that requires replacing and not suitable for conversion to heat network. ASHP to GSHP Split taken from current deployment by local authority and split by domestic and non-domestic.
Heat network	Most suitable for densely populated areas when used in blocks of flats, apartments, or other areas where heating systems can be shared or there is access to waste heat such as near industrial centres. These too could be ground source heat pumps if a ground loop array is shared between multiple users.	Retrofit deployment rates taken from WPD DFES and combined with assumptions around the conversion of current fossil fuel community heating schemes.
Heating controls	Accompanies other measures to allow users to fluctuate heat usage in line with prices, needs and grid carbon intensity.	Assumed to be installed in all domestic properties without any control of heating system. Installed in non-domestic properties with EPC recommendation.

Installation types in scope

Outside of retrofit installations, labour will be required to service retrofit measures across their lifetime and across a range of construction types. This will differ between technologies, for example, cavity wall insulation requires a negligible level of maintenance in comparison to air source heat pumps. Requirements for labour come from:

- **Retrofit –** Retrofitting a property with a new measure.
- **New builds –** Installing a low carbon heating or insulation measure in a newly constructed property.

- **Maintenance –** Servicing and repair of low carbon heating or insulation measures.
- **Refits –** Replacement of low carbon heating systems with new low carbon heating systems upon the end of the systems lifetime.

Construction Jobs in Scope

For the installation, servicing and maintenance of insulation measures, a series of different jobs will be required. For insulation. These jobs are the for the installation of the different measures, for example, a cavity wall insulation installer, and for retrofit services. A description of these jobs is below:

Table 7- Insulation jobs included

JOB	DESCRIPTION
Cavity wall insulation installer	Labour possessing skills required for construction of cavity wall insulation.
Solid wall insulation installer	Labour possessing skills required for construction of solid wall insulation.
Loft insulation installer	Labour possessing skills required for construction of loft insulation.
Double glazing installer	Labour possessing skills required for construction of double glazing.
Retrofit assessor	Labour possessing skills to determine the whole house insulation requirements.
Retrofit coordinator	Labour possessing skills to provide oversight for the retrofit process of multiple properties.

For low carbon heating, the jobs requirements analysed within this analysis are:

Table 8 - Low carbon heating jobs included

JOB	DESCRIPTION
Heat pump engineer	The primary installer of both ground and air source heat pumps. The heat pump engineer is responsible for preparing the unit, completing heat loss calculations and other design processes. Engineer is also the primary provider of maintenance and replacement services.
Heat pump electrician	Responsible for configurations for to the wiring required to install heat pumps. Predominantly required for

	retrofit heat pumps as opposed to new builds, refits and maintenance.
Groundworker	Manual labour required to install ground loops for ground source heat pumps and some heat networks.
Heat network engineer	Engineer responsible for installing and maintaining heat network connections.
Heating controls installer	Installer responsible for fitting heating controls such as smart thermostats.

Quantitative methodology

Retrofit quantitative analysis methodology

As part of this study, multiple methods and data points were used to carry out the economic analysis. Some of the data sources drew on publicly available information, while others used a mixture of internal data and models developed by Gemserv specifically for understanding retrofit skills growth. The table below provides a high-level overview of how the major analysis pieces were conducted.

Table 9- Summary of analysis approach

Analysis	Brief description of approach
Local EPC data summary	To account for properties without an EPC record, a stratified sample was formed to account for any selection bias caused by properties without an EPC record having different characteristics to those with an EPC record. For domestic homes, targeted EPC records were duplicated according to access to gas grid[183], floor area[184] and tenure[185]. For non-domestic properties, the sample was stratified based on total properties and access to the gas grid alone.
Off-gas grid data	Calculated using combined approach of analysis of EPC stock and external data[186].

[183] BEIS (2022) Regional and local authority gas consumption statistics
[184] BEIS (2022) National Energy Efficiency Data-Framework (NEED): consumption data tables 2021
[185] DLUHC (2022) Live tables on dwelling stock (including vacants)
[186] BEIS (2022) Regional and local authority gas consumption statistics

% of solid wall insulation properties	EPC records were assessed for having solid walls using a key word search on the description of the properties walls. Where data was missing, assumptions were made using the age and type of property.
Age of housing stock	Construction age bands were aggregated according to EPC data records.
Housing stock archetype	Utilising a key word search and a range of assumptions around heating systems, the primary heating fuel was determined for each EPC record. This was used to best match EPC records to archetypes according to Tabula[187], using the properties size, type, heating fuel and construction age band.
Current number of retrofit installations	For heat pumps, data on accredited installs was taken from MCS[188]. Estimates for the ratio of accredited installs to non-accredited installs were calculated by comparing the total number of EPC records with heat pump installations to those given in the MCS data. For cavity wall insulation, loft insulation and solid wall insulation installations, data was taken from regional summaries of retrofit funding schemes[189] and scaled down to each local authority by applying assumptions based on the outputs of the EPC summary analysis. For heating controls, heat networks and double glazing, it was assumed that current labour operated at the same capacity as the average of that of similar labour types. For example, for double glazing, the operating capacity of loft, cavity wall, and solid wall insulation installers was estimated and applied to double glazing installers in the region.
Baseline number of installs: retrofit vs new	Using assumptions around installation types for accredited installs, the share of heat pumps that were installed in retrofit and new properties was assessed by analysing properties with EPC records lodged due to the property being newly constructed that also had a heat pump as the primary heating system.
Baseline number of installer jobs	For the total labour in the region, employment estimates were taken from regional ONS data[190] and scaled down to the analysis area using

[187] Tabula (2014) National building typologies
[188] MCS (2022) The MCS Data Dashboard
[189] BEIS (2022) Household energy efficiency
[190] ONS (2022) Exploring regional estimates of activity in the low carbon and renewable energy economy, UK and regions of England: 2020

	SIC code mapping based on the labour split of different industries. Reasoned assumptions were used to scale down from the ONS category definitions to the sectors within scope. Employment estimates were then broken down into specific employment types using ONS estimates of splits by industry[191]. For example, retrofit assessors and coordinators were taken using the professional services share of regional employment estimates for the "other energy efficiency products" category. Total employment within each sector was broken down by services offered and local authority using MCS data[192] and key word analysis/geocoding of Trustmark, NIA, and IAA data[193].
Number of measures required for net zero	For domestic properties, wall, loft, heating control and window descriptions were taken from EPC records and combined with assumptions for retrofit requirement as detailed in the main text. For non-domestic properties, a key word search of EPC recommendations data was used to analyse the need for insulation measures and heating controls. The requirements for retrofit low-carbon heating systems was taken by analysing EPC records to see whether homes had fossil fuel heating systems. Additional demand from new build properties in the region was taken from central DFES projections[194]. The potential deployment of heat network connections was also taken from DFES projections with the scenario used depending on the scenario used within our analysis[195]. Where forecast data was not available for each local authority, weighted averages were took using population density[196]. Remaining demand for low carbon heating, from existing and new properties, was then split between air and ground source heat pumps according to domestic and non-domestic accredited installation splits[197].

[191] ONS (2022) Low carbon and renewable energy economy, UK: 2020
[192] MCS (2022) The MCS Data Dashboard
[193] Trustmark (2022) Advanced Search; NIA (2022) Find an installer; IAA (2022) Find your local installer
[194] Western Power Distribution (2023) Distribution Future Energy Scenarios
[195] Western Power Distribution (2022) Distribution Future Energy Scenarios
[196] ONS (2022) Estimates of the population for the UK, England, Wales, Scotland and Northern Ireland
[197] MCS (2022) The MCS Data Dashboard

Estimated bill savings	Energy reduction estimates were calculated using heat loss transmittance coefficients of different insulation levels off Tabula, for each housing archetype[198]. These were combined with long-term fuel prices to calculate bill savings. Bills savings were then combined with retrofit costs[199] to calculate payback times.
Job projection assumptions (type and number)	Annual installations were split out according to scenario deployment reference curves. For insulation measures, these were then adjusted according to current labour provision (and operating capacity assumptions) and payback times of each property's collective retrofit measures. The replacement cycle of low carbon heating systems was estimated using historical deployment data and assumptions around system lifetimes. Employment intensities for retrofit installations, refit installations, new build installations and maintenance were taken from a variety of sources and/or modelling assumptions and used to calculate labour requirements for each year. Productivity increases were estimated using trends in turnover to employment ratios from the ONS[200].
Transferable skills and heating industry forecasts	Using data from the Gas Safe Register[201], Oftec[202], internal survey data[203], and the SMF[204], and combining with population estimates by local authority[205] and heat pump installer employment estimates, the number of fossil fuel heating engineers per local authority was estimated. A combination of internal survey data and historic training data[206] was used to estimate the age profile of the heating industry and was combined with evidenced inputs on retirement age, attrition rate and training rates to form forecasts of the size of the heating industry to 2050. These forecasts informed inputs on the future retirement rate of the heating industry.

[198] Tabula (2014) National building typologies
[199] BEIS (2017) Domestic cost assumptions - what does it cost to retrofit homes?; BEIS (2018) ECO 3 Impact Assessment
[200] ONS (2022) Low carbon and renewable energy economy, UK: 2020
[201] Gas Safe Register (2017) Decade Review
[202] Oftec (2022) Where are all the female heating engineers?
[203] Gemserv (2022) Heating system installers share their views on the opportunities and risks they face in the transition to low carbon
[204] Social Market Foundation (2022) Installation for time?
[205] ONS (2022) Population profiles for local authorities in England
[206] Ofqual (2023) Vocational and other qualifications over time

ANNEX 4: ADDITIONAL FIGURES AND GRAPHS

Retrofit

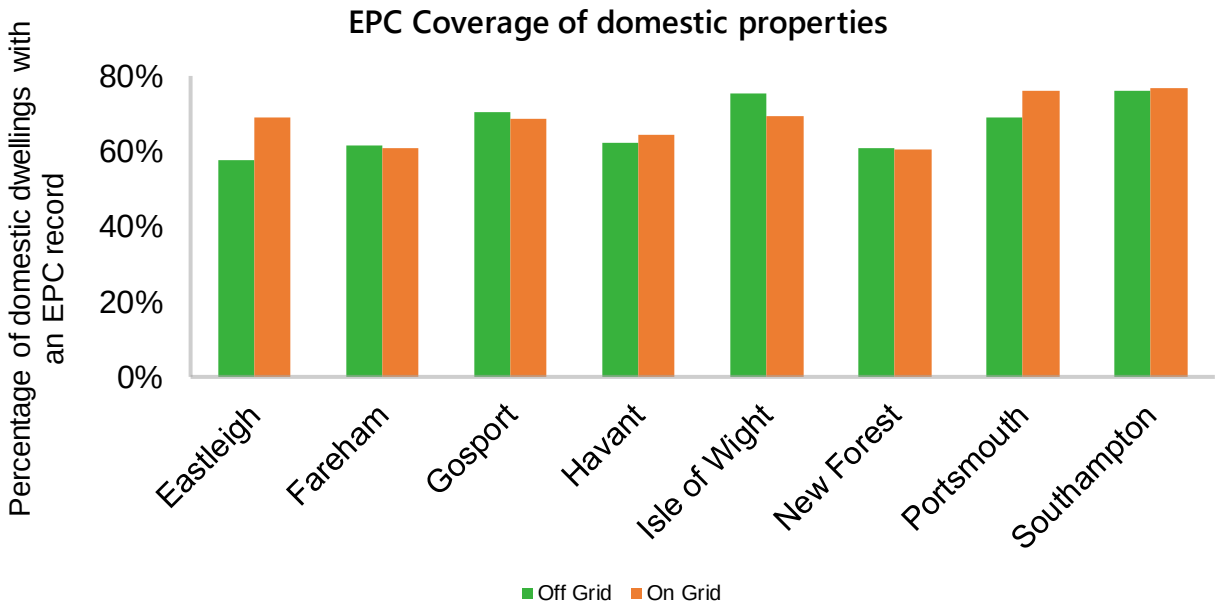

Figure 55 - EPC Coverage of Local Authorities in the Solent

Required installation amounts and deployment rate for net zero

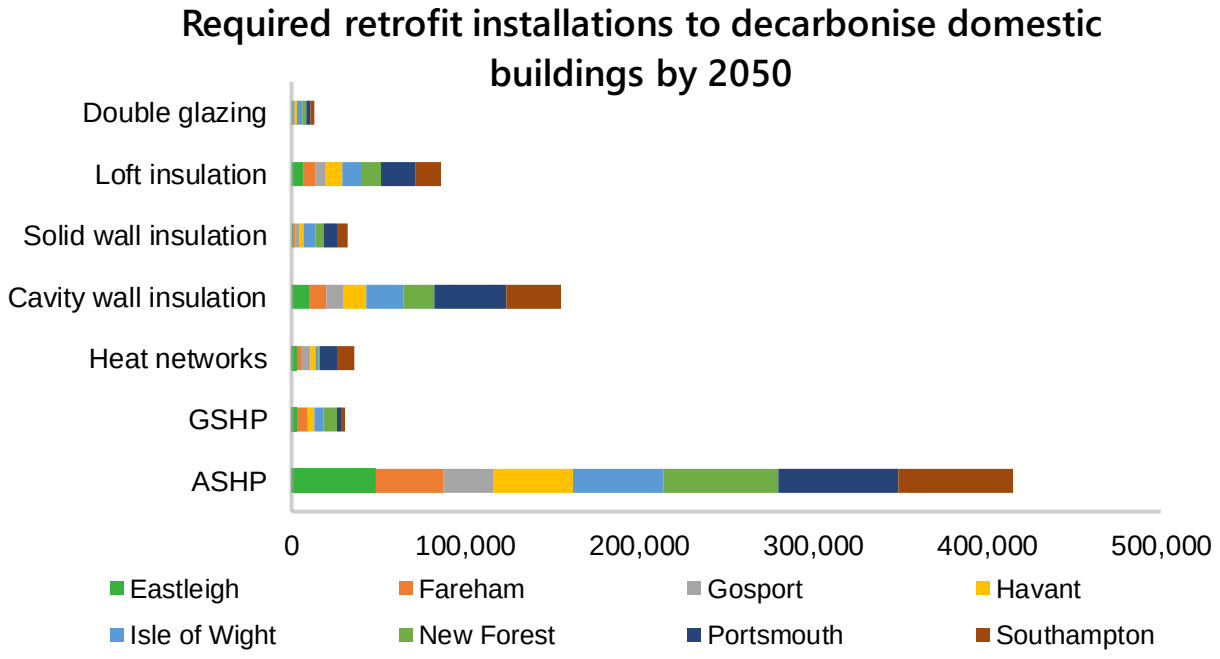

Figure 56 - Required retrofit installations to decarbonise domestic buildings

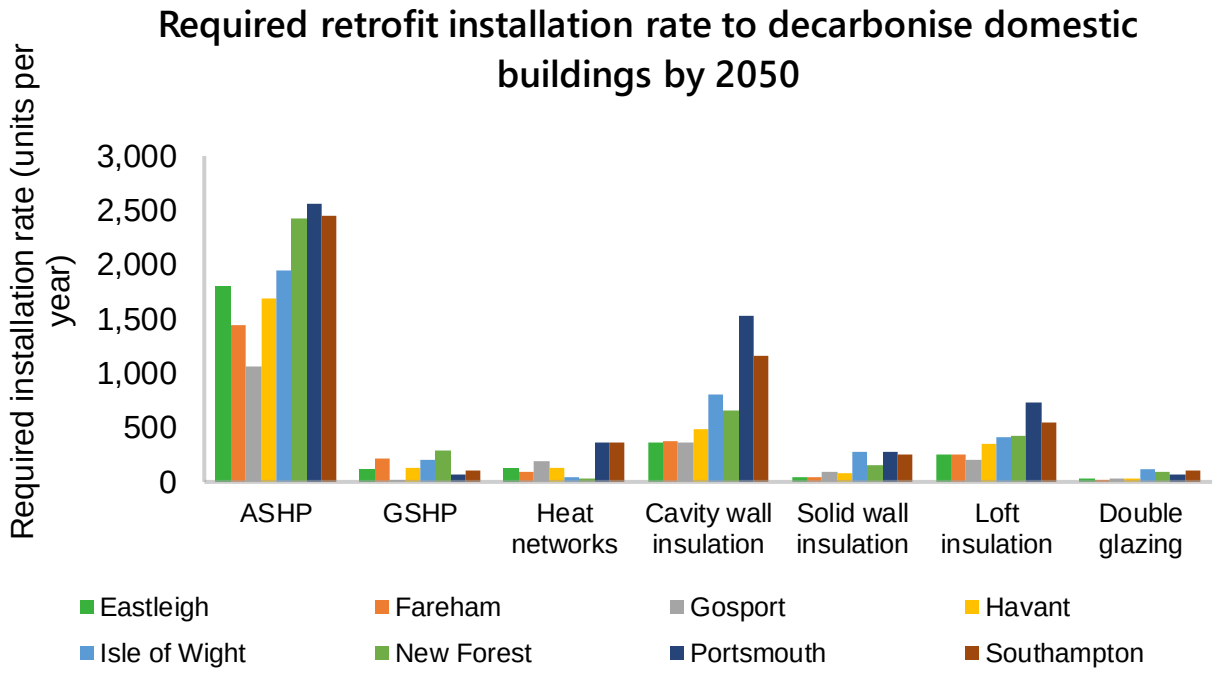

Figure 57 - Required retrofit installation rate to decarbonise domestic buildings by 2050

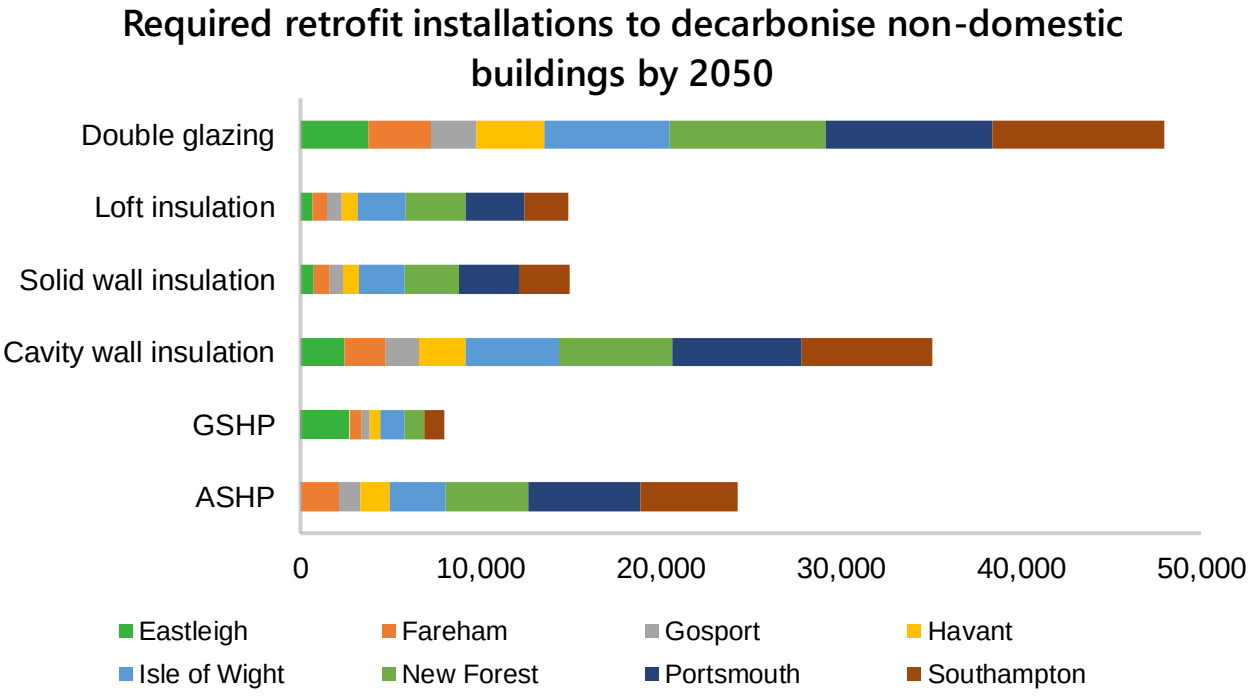

Figure 58 - Required retrofit installations to decarbonise non-domestic buildings by 2050

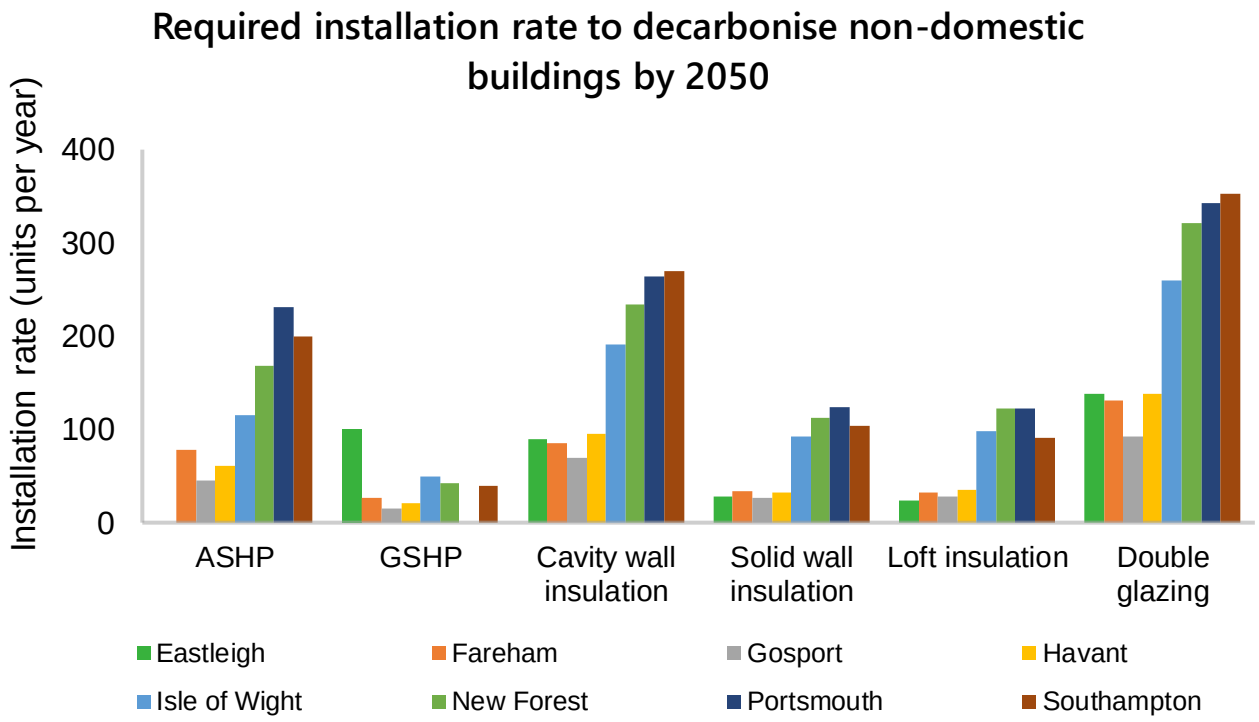

Figure 59 - Required installation rate to decarbonise non-domestic buildings by 2050

Required growth in energy efficiency measures to reach net zero

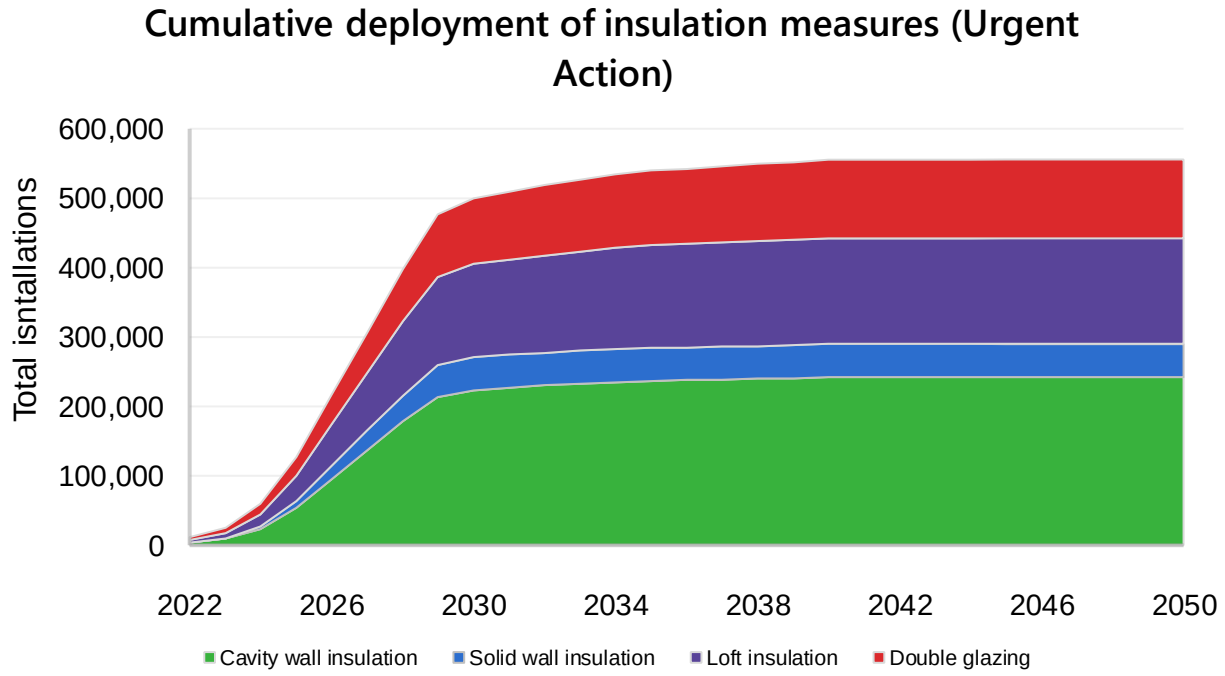

Figure 60 - Cumulative deployment of insulation measures (Urgent Action)

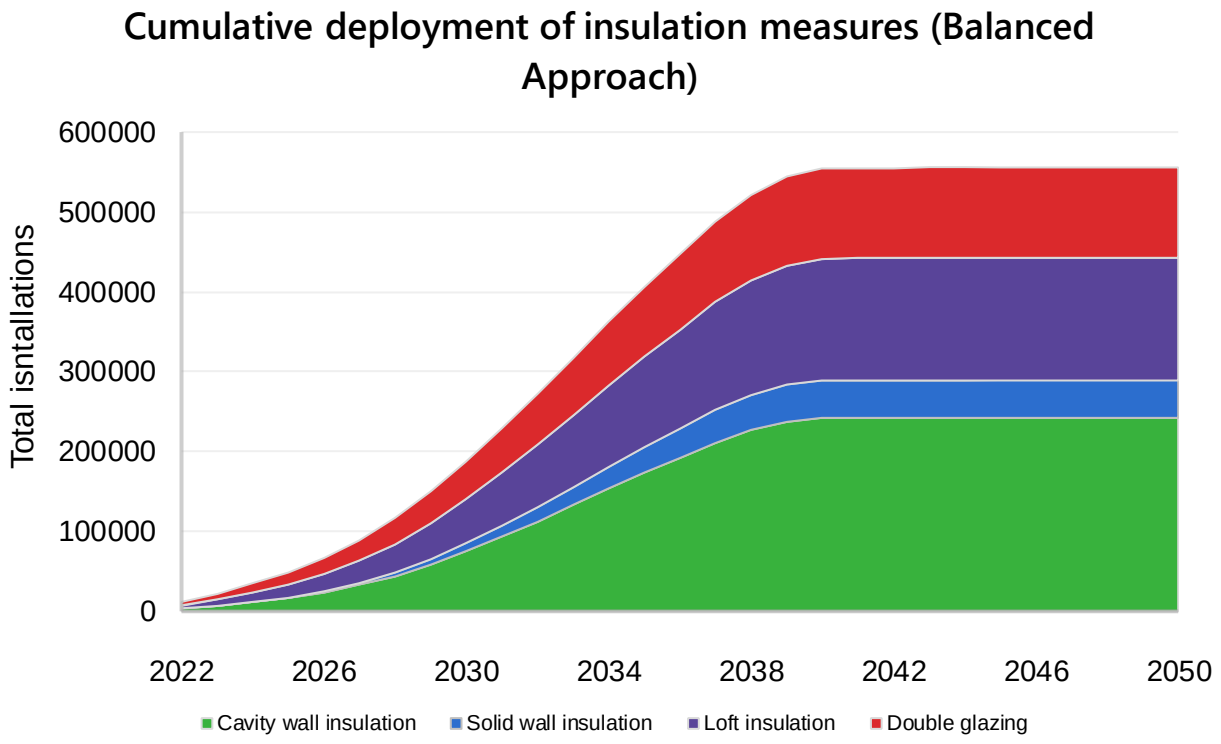

Figure 61 - Cumulative deployment of insulation measures (Balanced Approach)

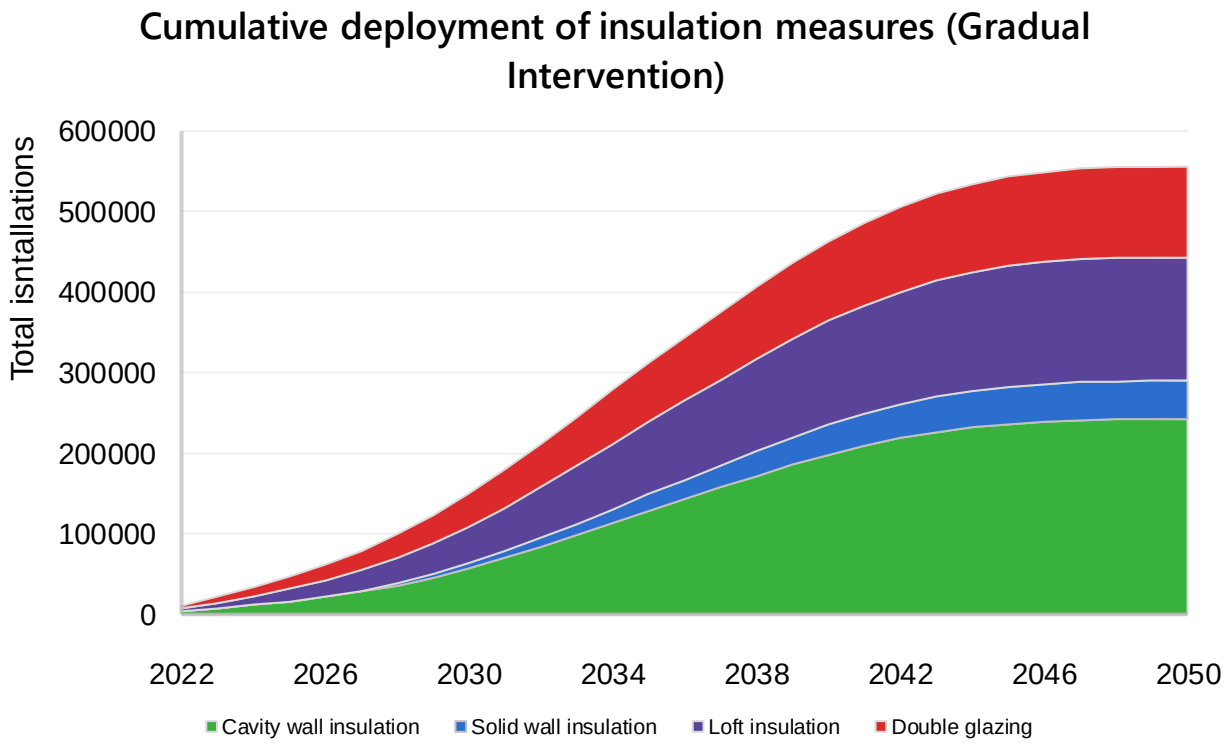

Figure 62 - Cumulative deployment of insulation measures (Gradual Intervention)

Required growth in low carbon heating for Net Zero

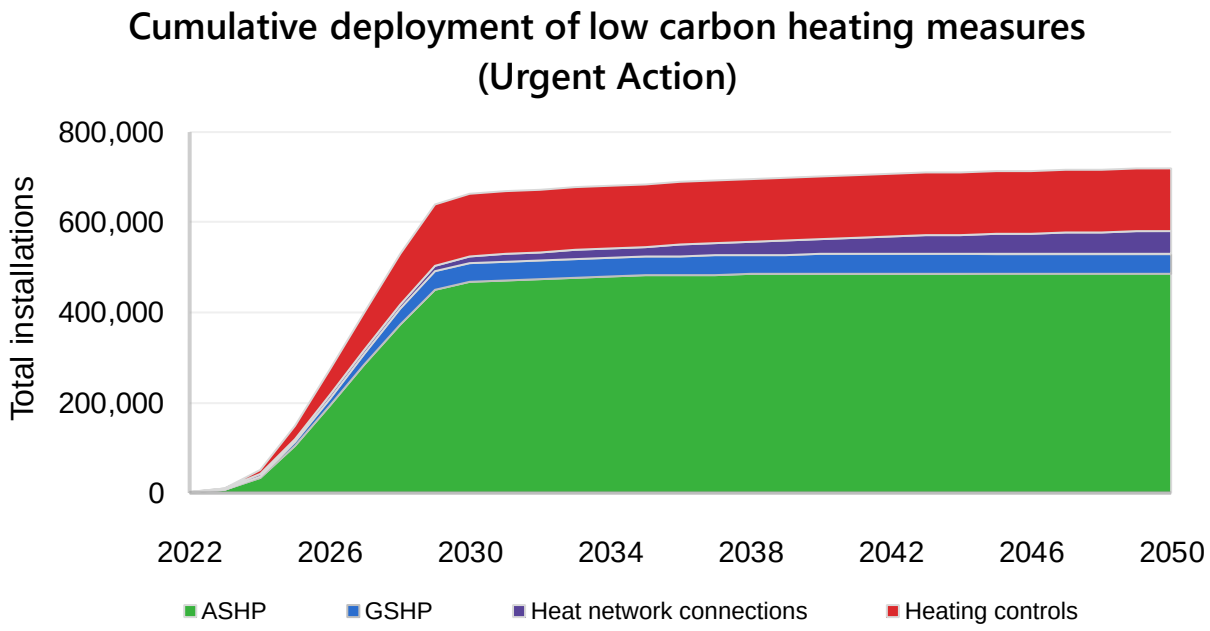

Figure 63 - Cumulative Deployment of Low Carbon Heating Measures (Urgent Action)

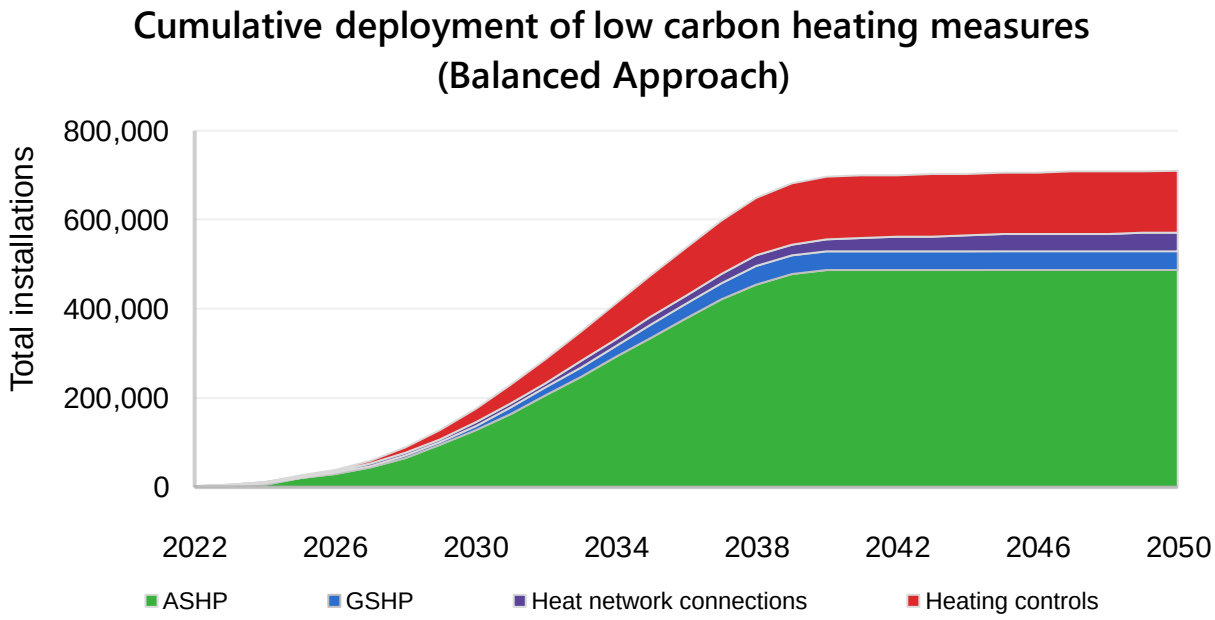

Figure 64 - Cumulative Deployment of Low Carbon Heating Measures (Balanced Approach)

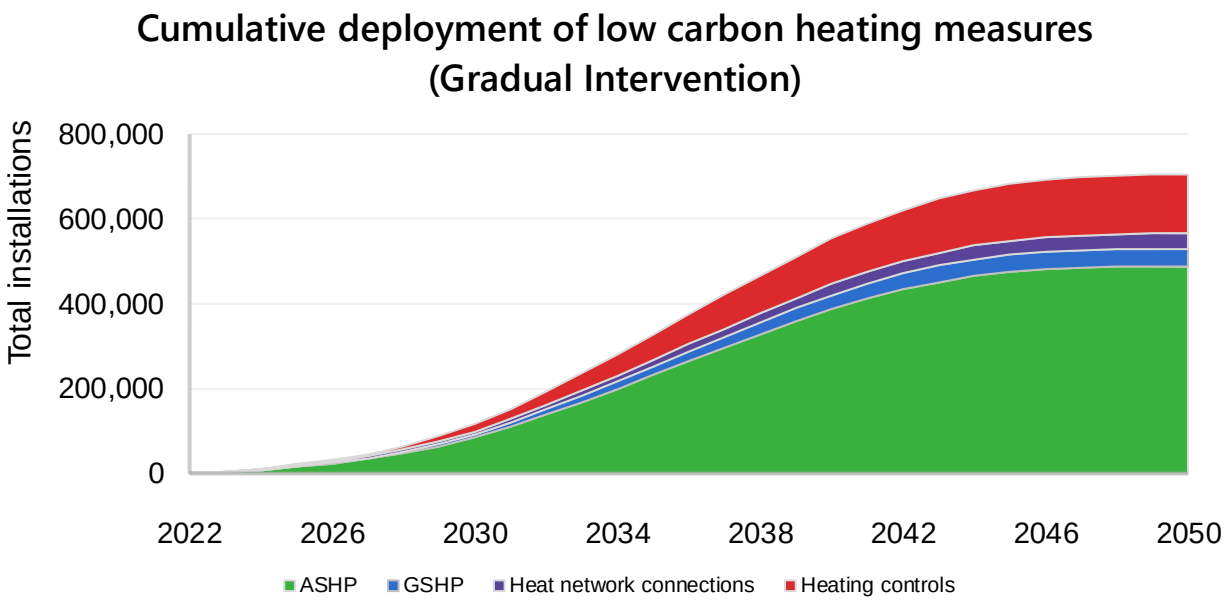

Figure 65 - Cumulative deployment of low carbon heating measures (Gradual Intervention)

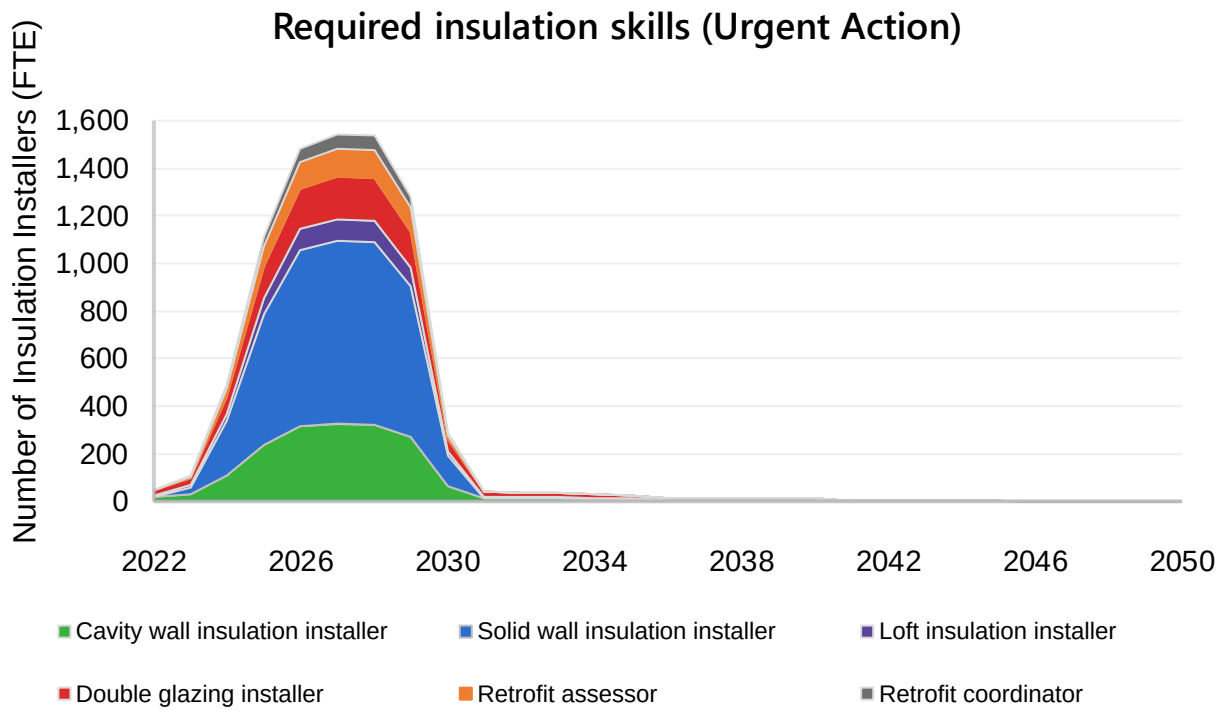

Figure 66 - Required insulation skills (Urgent Action)

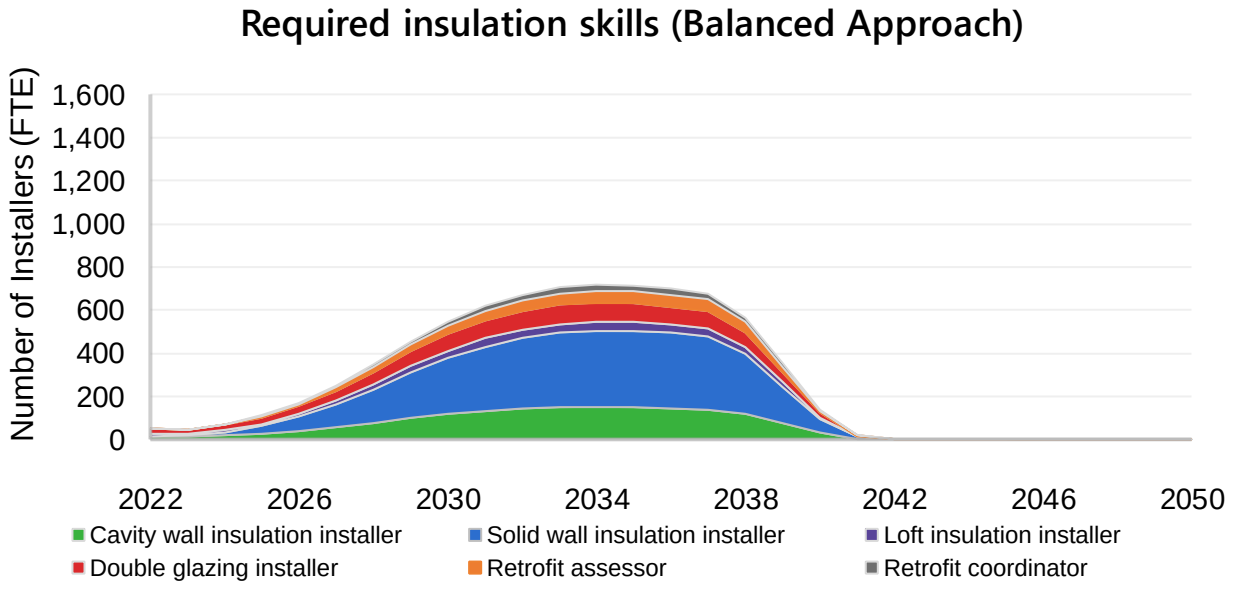

Figure 67 - Required insulation skills (Balanced Approach)

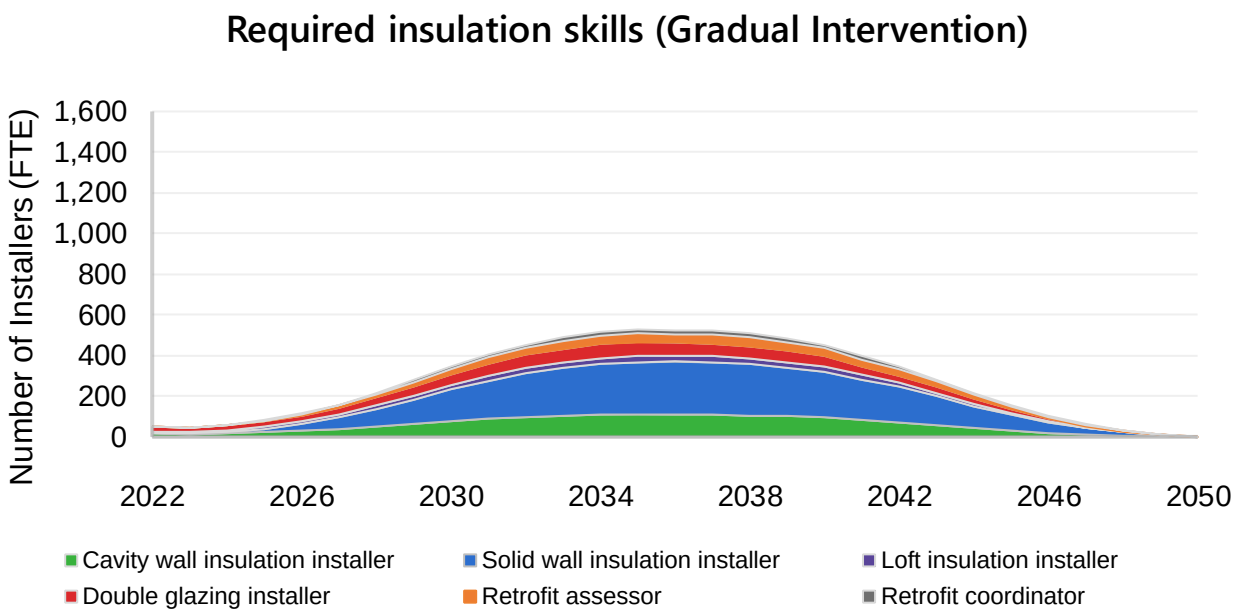

Figure 68 - Required insulation skills (Gradual Intervention)

Low carbon heating and heat pump workforce requirements

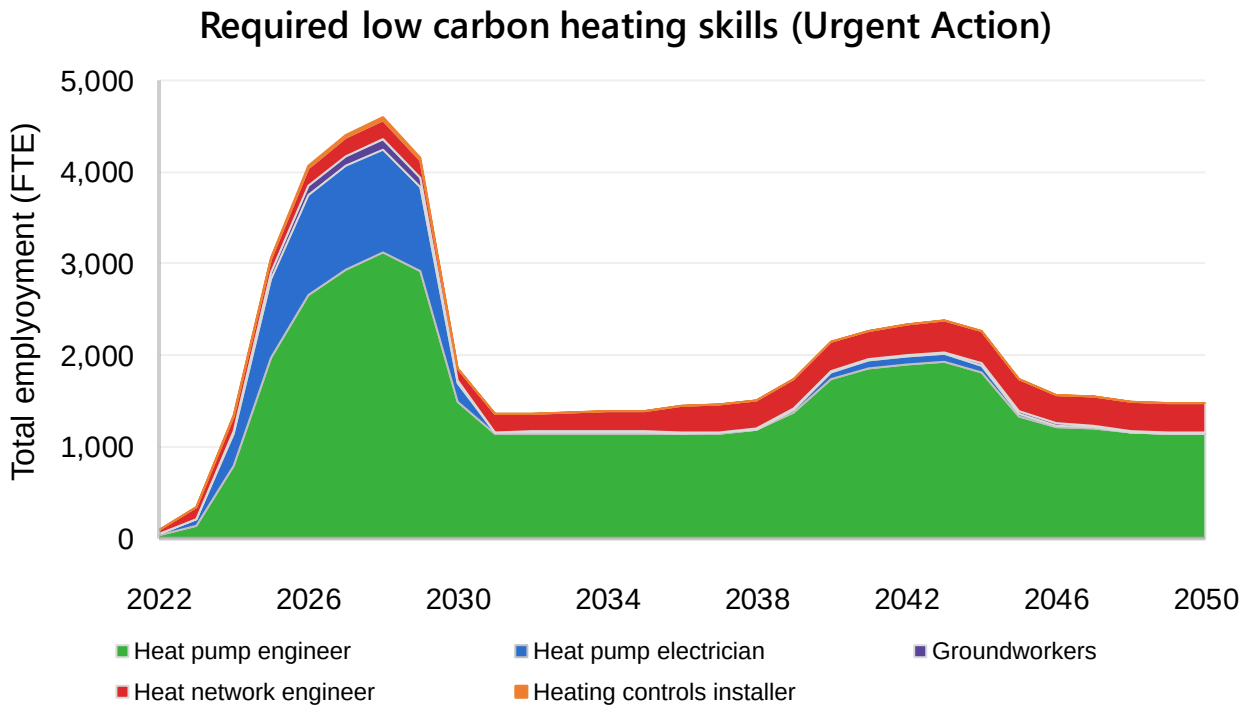

Figure 69 - Required low carbon heating skills (Urgent Action)

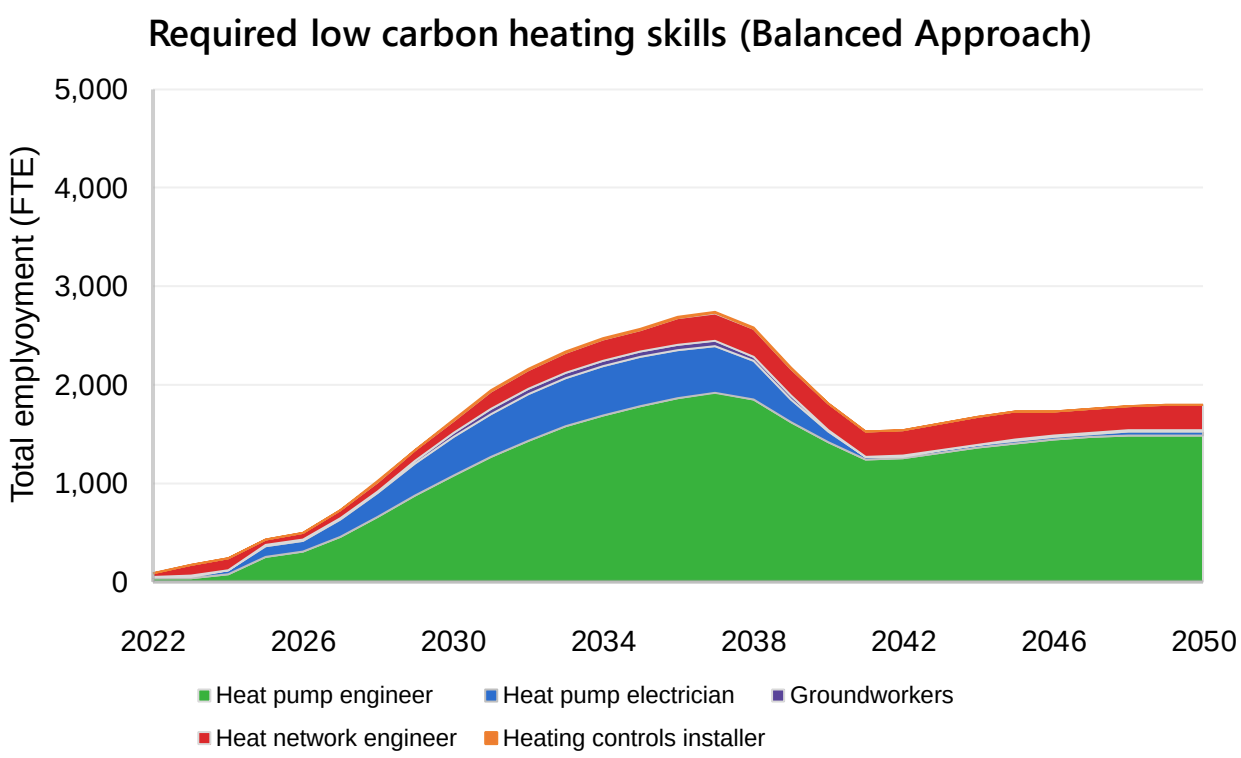

Figure 70 - Required low carbon heating skills (Balanced Approach)

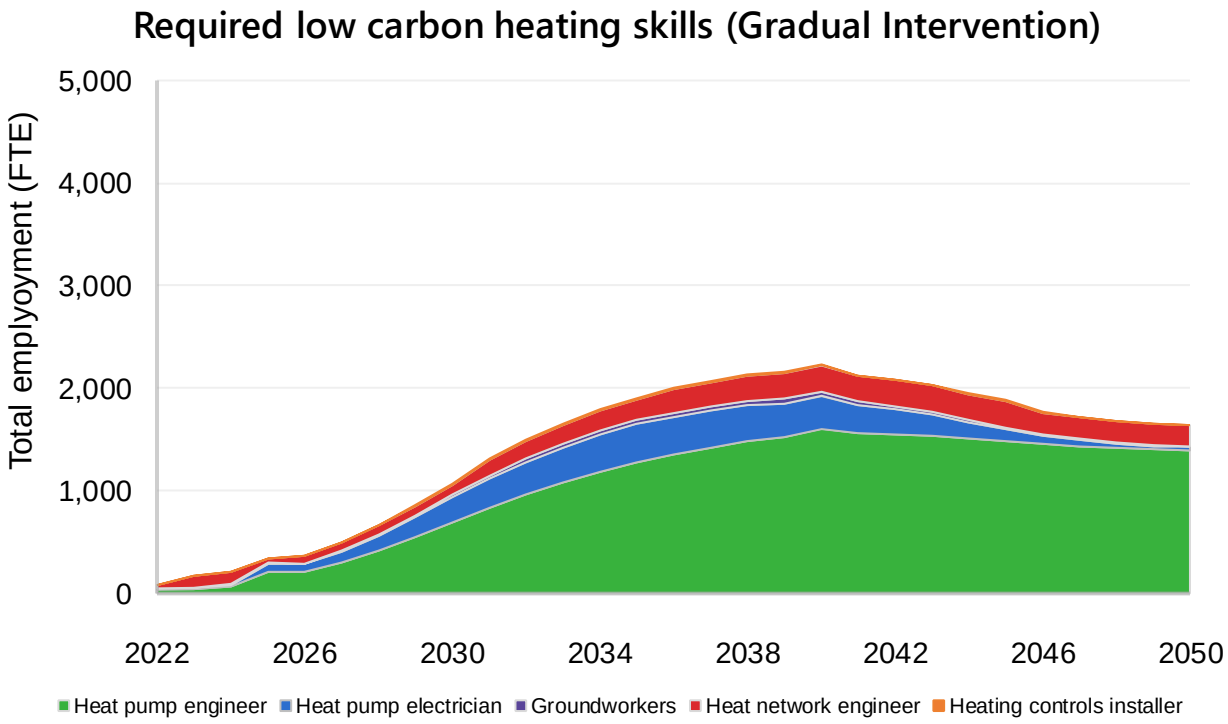

Figure 71 - Required low carbon heating skills (Gradual Intervention)

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