Harrogate & The Dales

Local Area Energy Plan

CATAPULT
Energy Systems

York & North Yorkshire
LOCAL ENTERPRISE
PARTNERSHIP

HM Government

LOCAL
AREA
ENERGY
PLAN

Summary

Summary

To achieve a net zero energy system by **2040**, the Dales' local area energy plan requires capital investment of

£8.6 billion
Total (excluding electric vehicles and charging infrastructure)

Including:

£1.3 billion
in dwellings (including building fabric upgrades, heating systems and rooftop solar PV)

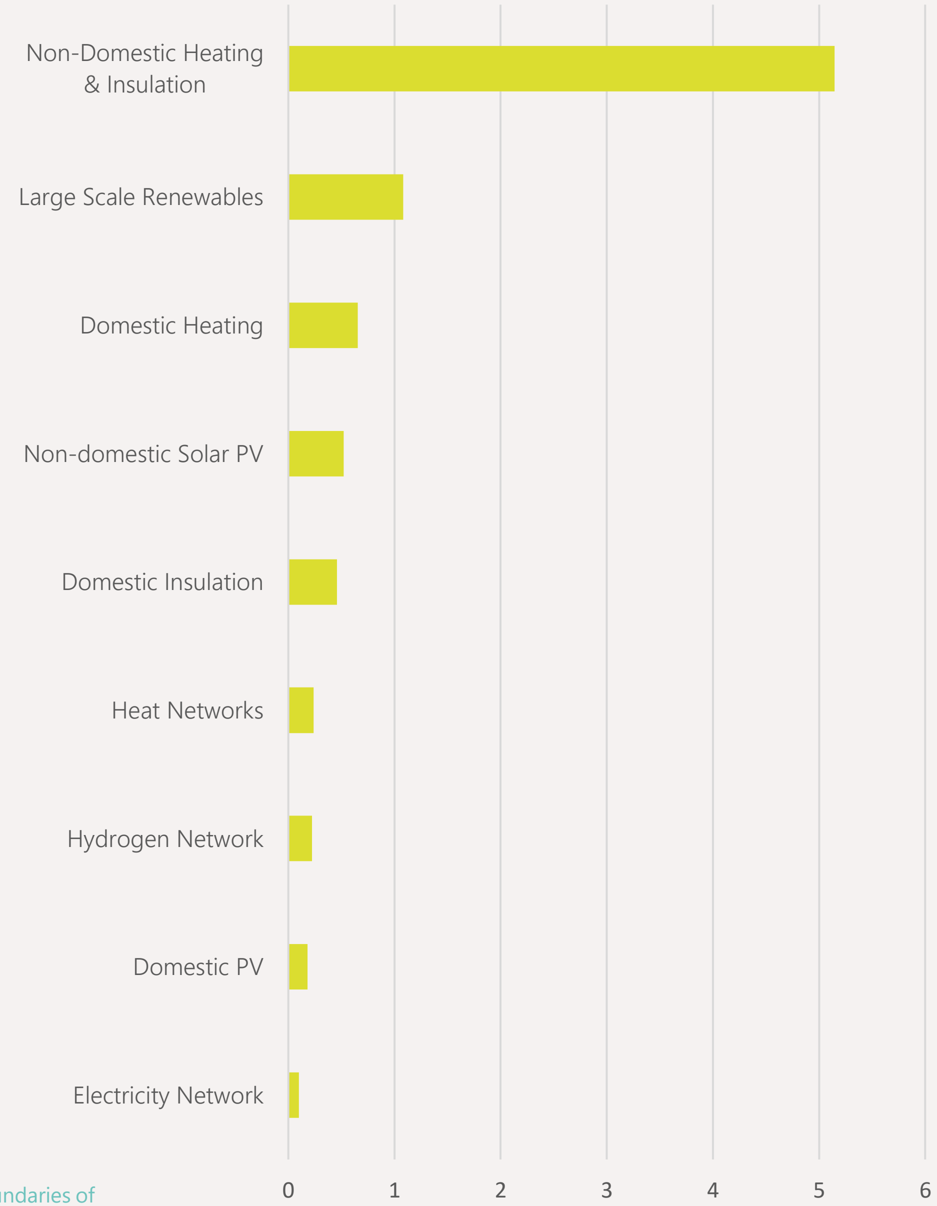
£1.1 billion
In large scale renewable generation

Saving:

2.4 million tonnes CO_2

From buildings cumulatively to 2050 against a business-as-usual pathway – equivalent to more than ten return flights to New York for every household.

Total Capital Investment



The Dales' energy system will have been transformed, with:

122,000
heat pumps installed in dwellings

At least 1,400 **new connections to a district heat network**

71,000
dwellings retrofitted with insulation, glazing and draughtproofing improvements

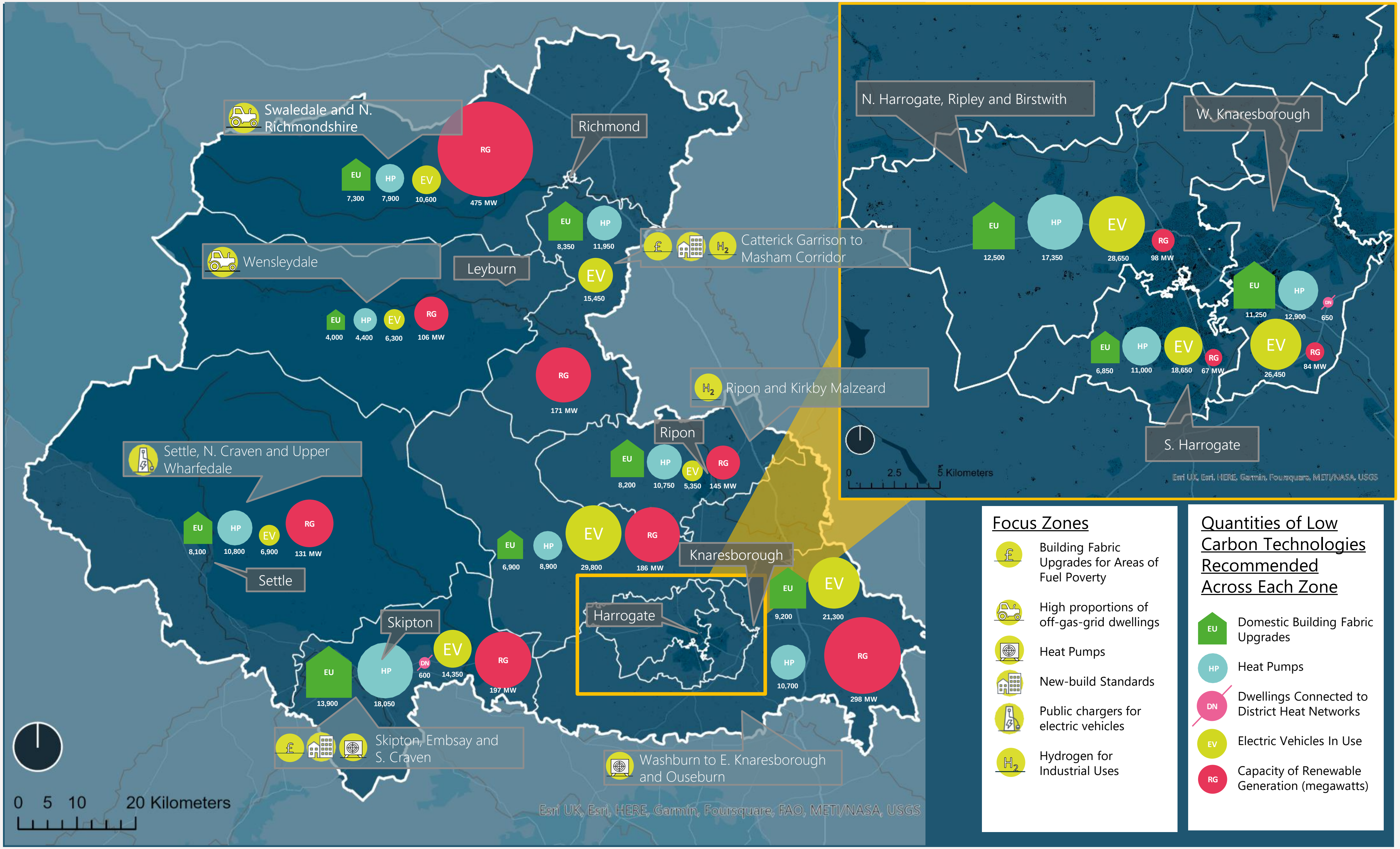
204,000
fully electric vehicles

26%
dwellings generating their own electricity with rooftop solar

2,000 MW
of large scale renewable generation

Note: This report focuses on the current district council boundaries of Richmondshire, Craven and Harrogate, including all rural and urban areas, which for brevity we are referring to as the "Harrogate & the Dales" or "the Dales"

Plan on a Page



This report focuses on the current district council boundaries of Richmondshire, Craven and Harrogate, including all rural and urban areas, which for brevity we are referring to as the "Harrogate & the Dales" or "the Dales"

Outline Priority Projects Summary

Demonstrator and low regrets projects for near-term implementation

Domestic Air Source Heat Pump Installations in the Skipton, Embsay and S. Craven Zone

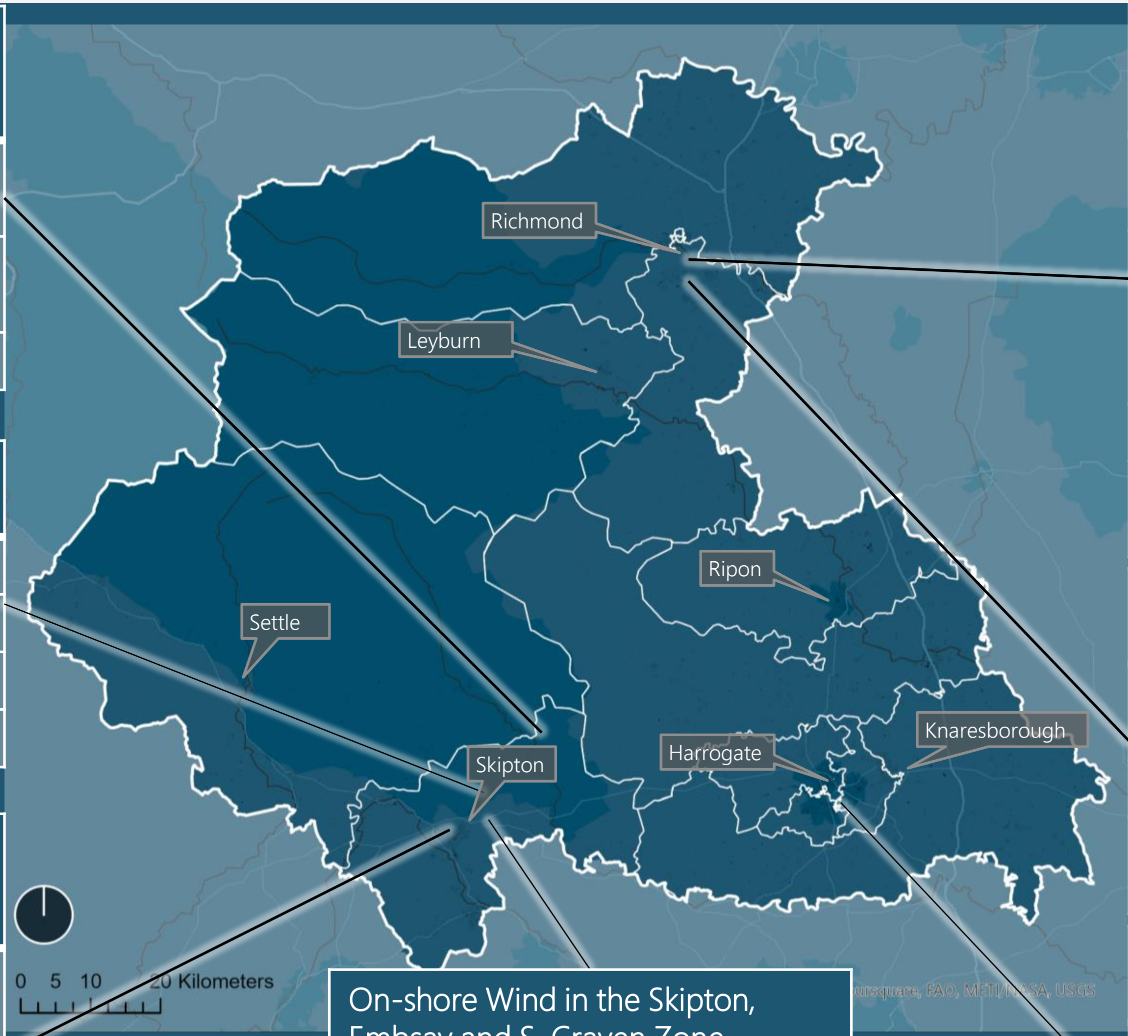
Number of Dwellings	7,200
Predominant Type	Terrace
Capital	~£50m

Ground Mounted Solar in the Skipton, Embsay and S. Craven Zone

Capacity	30MW
Generation	29 GWh/annum
Land Use	50
Capital	~£15.9m

Domestic Building Fabric Upgrades in the Skipton, Embsay and S. Craven Zone

Number of Dwellings	c. 215
Predominant Type	Pre-1914-1979 terrace
Capital	~£0.4m
Additional Benefit	Fuel poverty reduction



On-shore Wind in the Skipton, Embsay and S. Craven Zone

Capacity	2MW
Generation	4.4 GWh/annum
Land Use	90 hectares
Capital	~£2.5m

Domestic Building Fabric Upgrades in the Catterick Garrison to Masham Corridor

Number of Dwellings	c. 760
Predominant Type	1965-1979 terrace 1945-1964 semi-detached
Capital	£0.5m
Additional Benefit	Fuel poverty reduction

Domestic Solar PV Installations in the Catterick Garrison to Masham Corridor

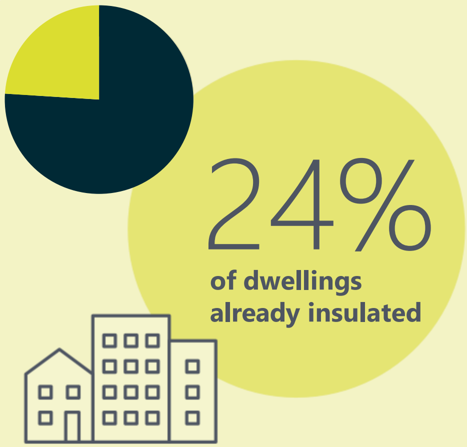
Number of Dwellings	c. 1,800
Capital	~£9m
Additional Benefit	Fuel poverty reduction

Heat Network Starting Point in Harrogate Centre

Number of Dwellings	c. 1,200
Number of Non-Domestic Properties	c. 870
Peak Demand	19 MW
Capital	~£37m

Current State

Setting the Scene: Harrogate & The Dales Today

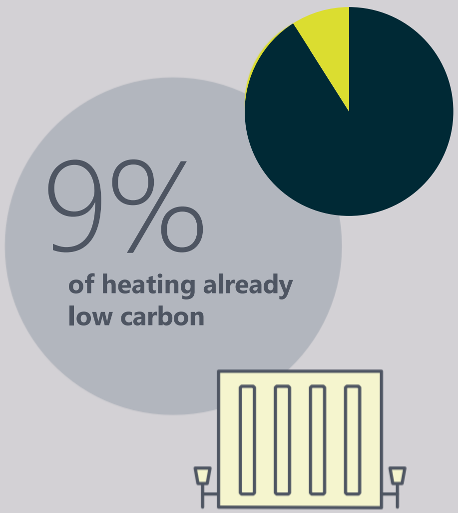


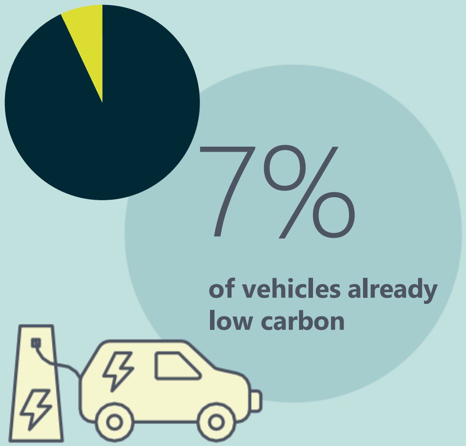
BUILDINGS

Currently 29,600 (24%) of Harrogate & The Dales' 124,450 homes are insulated to a good standard, or do not have potential for further insulation.

HEATING

Approximately 113,000 dwellings (91%) currently use gas, oil or LPG for heating. The remaining 11,500 already use some form of low carbon heating such as heat pumps, biomass or electric resistive heating.



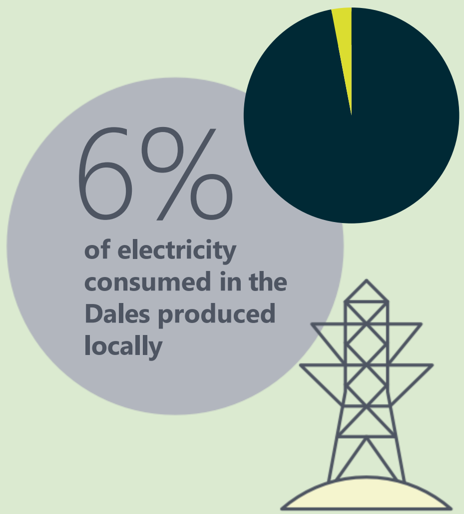


VEHICLES

Around 12,800 (7%) of the 174,100 cars and vans currently registered in Harrogate & The Dales are either plug-in hybrid or pure electric. The remainder and vast majority are petrol, diesel or hybrid.

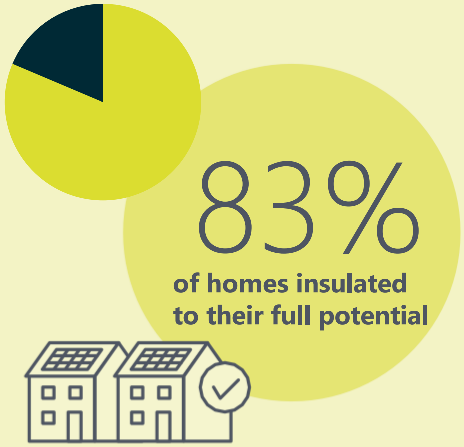
ELECTRICITY

94% of electricity consumed comes from the National Grid. At least 3% of dwellings have solar panels, and rooftop solar on non-domestic builds also contributes to local demand.



Destination

The Destination: The Dales 2040

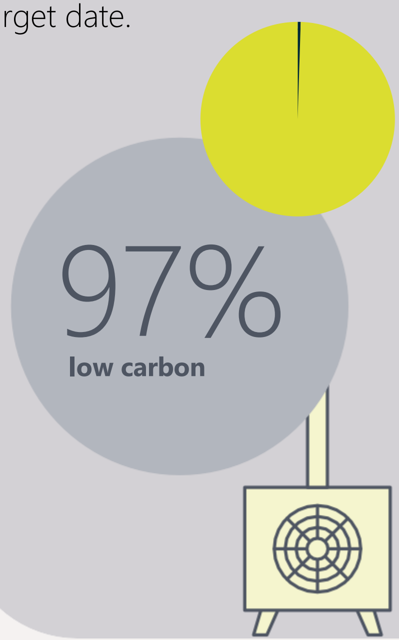


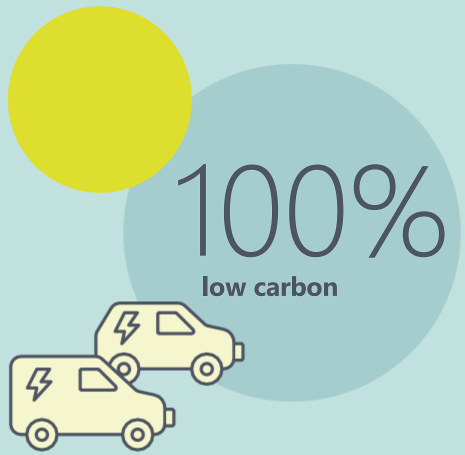
BUILDINGS

Around 57% of the Dales' buildings will require insulation upgrades, bringing the majority of homes up to a high standard of building fabric performance. The supply chain would need to provide upgrades to around 70,700 dwellings by the year 2040. New builds will also add to the proportion of well-insulated dwellings.

HEATING

Virtually all fossil fuelled heating systems need to be replaced in order to reach net zero, with 122,000 heat pumps installed. This can occur as current heating systems reach their natural end-of-life but scrappage (or similar) schemes will need to be considered to ensure that all heating systems are decarbonised before the target date.



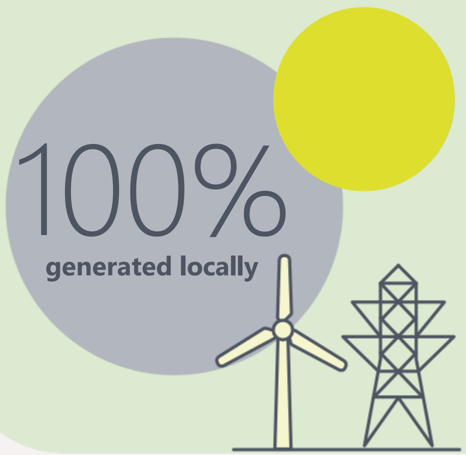


VEHICLES

Electric vehicle use is projected to rise rapidly, and would need to reach 100% (194,000 vehicles) by 2040 to meet the net zero target. Steps will need to be taken to cater for these users with provision of public charge points, and assist residents to install domestic chargers. These chargers will place new demands on the electrical distribution system.

ELECTRICITY

There is enough land and roof space for solar PV and wind to generate all of the Dales' electricity requirements (including electrified heating and transport) from local renewables on a net annual basis, using 17,500 hectares of land. In reality, there would likely be issues with generating this amount of electricity as large excesses would be produced, particularly in summer months.



The Pathways

Three pathways to net zero were modelled to understand which of the recommended actions could be affected by different net zero target dates. The three ambition levels are described as
Low: Aligning with the national 2050 net zero target
Medium: A balanced approach, achieving a net zero energy system locally by 2040, ahead of the UK as a whole.
High: An extremely ambitious push for a net zero energy system locally by 2030.

This plan focusses primarily on the medium ambition scenario, with key similarities and differences between the scenarios drawn out where appropriate. Actions that are common across these scenarios are considered to be 'low regrets' and can be undertaken as soon as possible. Actions that are not common and are identified later in the pathway will require decision points and early enabling actions to remove barriers.

The key similarities and differences between these ambition levels are summarised as follows.

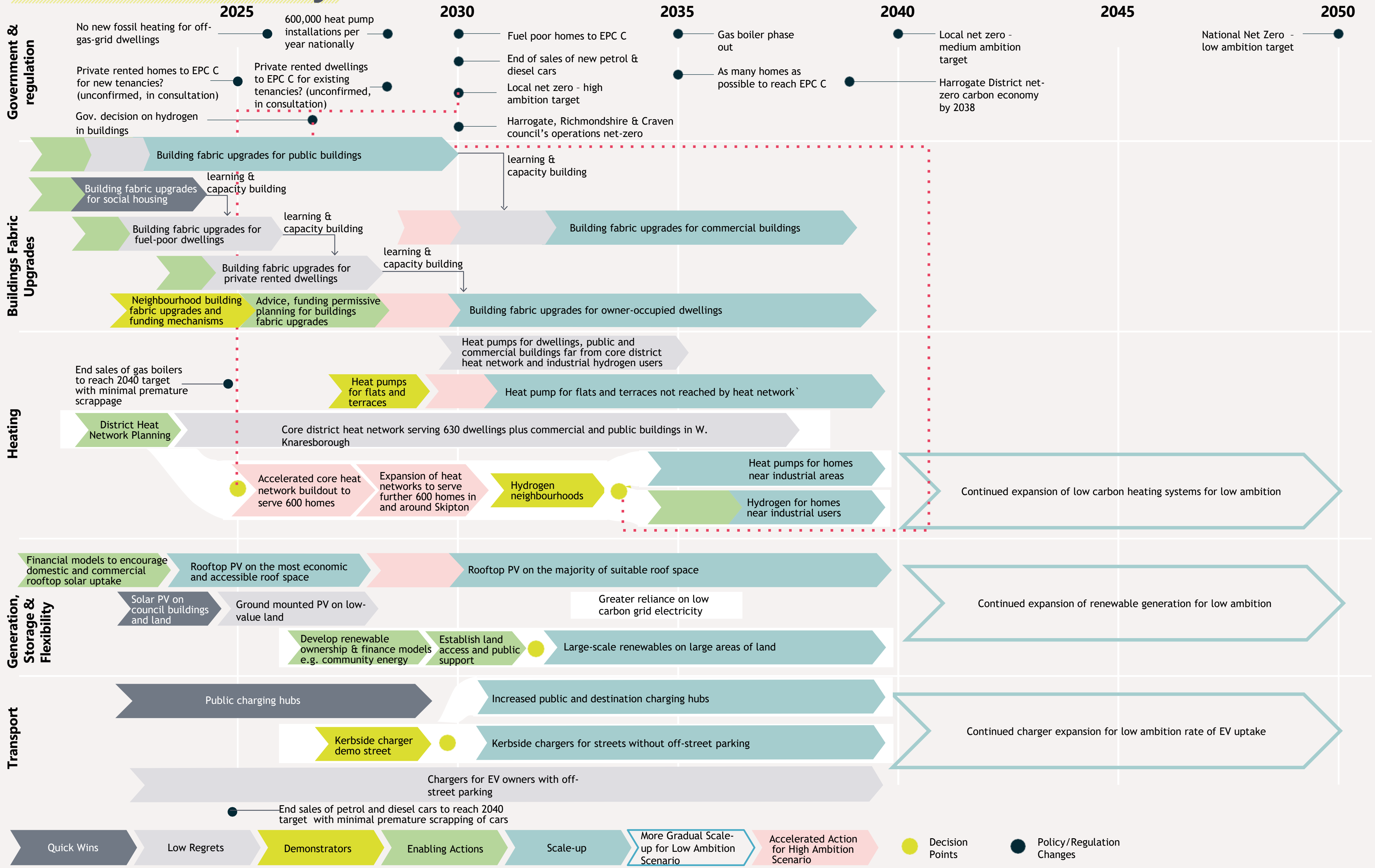
Low Regrets

- Basic building fabric upgrades for almost every dwelling which has upgrade opportunities.
- Heat pumps installed in homes which are far from any likely heat networks or industrial users of hydrogen.
- District heat networks to serve public, commercial and private buildings in the areas of dense heat demand.
- EV chargers for homes with off-street parking and public charging points in key hubs such as retail parks, supermarkets, etc.
- Solar PV on rooftops and on low value areas of land.

Key Decisions

- Deeper building fabric upgrades which will tend to have long payback periods, but can have additional benefits such as fuel poverty alleviation and employment creation.
- Hydrogen to heat homes close to areas of industrial use instead of heat pumps: once more evidence is available around the viability, cost, emissions and policy around hydrogen for building heating in the Dales, a decision can be made about homes in these areas. Hydrogen may be able to reduce the upfront cost and disruption of low carbon heating system installations.
- Further deployment of ground-mount solar PV to reduce emissions from consumption of grid electricity. In theory, very large areas of land could be used to produce most of the Dales' energy requirements on an annual basis, though the development of this extent of land could be challenging. Visual impact of developments would need to be assessed as part of feasibility studies, as well as alternative land uses. Greater deployment of local renewables can bring economic benefits and accelerate decarbonisation, while greater reliance on decarbonised grid electricity can reduce the difficulties around developing large areas of land.

The Pathway


2025
2030
2035
2040
2045
2050
Government & regulation
No new fossil heating for off-gas-grid dwellings
600,000 heat pump installations per year nationally
Fuel poor homes to EPC C
Gas boiler phase out
Local net zero - medium ambition target
National Net Zero - low ambition target
Private rented homes to EPC C for new tenancies? (unconfirmed, in consultation)
Private rented dwellings to EPC C for existing tenancies? (unconfirmed, in consultation)
End of sales of new petrol & diesel cars
As many homes as possible to reach EPC C
Harrogate District net-zero carbon economy by 2038
Local net zero - high ambition target
Gov. decision on hydrogen in buildings
Harrogate, Richmondshire & Craven council's operations net-zero
Buildings Fabric Upgrades
Building fabric upgrades for public buildings
learning & capacity building
Building fabric upgrades for social housing
learning & capacity building
learning & capacity building
Building fabric upgrades for commercial buildings
Building fabric upgrades for fuel-poor dwellings
learning & capacity building
Building fabric upgrades for private rented dwellings
Neighbourhood building fabric upgrades and funding mechanisms
Advice, funding permissive planning for buildings fabric upgrades
Building fabric upgrades for owner-occupied dwellings
Heating
Heat pumps for dwellings, public and commercial buildings far from core district heat network and industrial hydrogen users
End sales of gas boilers to reach 2040 target with minimal premature scrappage
Heat pumps for flats and terraces
Heat pump for flats and terraces not reached by heat network`
District Heat Network Planning
Core district heat network serving 630 dwellings plus commercial and public buildings in W. Knaresborough
Accelerated core heat network buildout to serve 600 homes
Expansion of heat networks to serve further 600 homes in and around Skipton
Hydrogen neighbourhoods
Heat pumps for homes near industrial areas
Hydrogen for homes near industrial users
Continued expansion of low carbon heating systems for low ambition
Generation, Storage & Flexibility
Financial models to encourage domestic and commercial rooftop solar uptake
Rooftop PV on the most economic and accessible roof space
Rooftop PV on the majority of suitable roof space
Continued expansion of renewable generation for low ambition
Solar PV on council buildings and land
Ground mounted PV on low-value land
Greater reliance on low carbon grid electricity
Develop renewable ownership & finance models e.g. community energy
Establish land access and public support
Large-scale renewables on large areas of land
Transport
Public charging hubs
Increased public and destination charging hubs
Continued charger expansion for low ambition rate of EV uptake
Kerbside charger demo street
Kerbside chargers for streets without off-street parking
Chargers for EV owners with off-street parking
End sales of petrol and diesel cars to reach 2040 target with minimal premature scrapping of cars
Quick Wins
Low Regrets
Demonstrators
Enabling Actions
Scale-up
More Gradual Scale-up for Low Ambition Scenario
Accelerated Action for High Ambition Scenario
Decision Points
Policy/Regulation Changes

Buildings

Overview

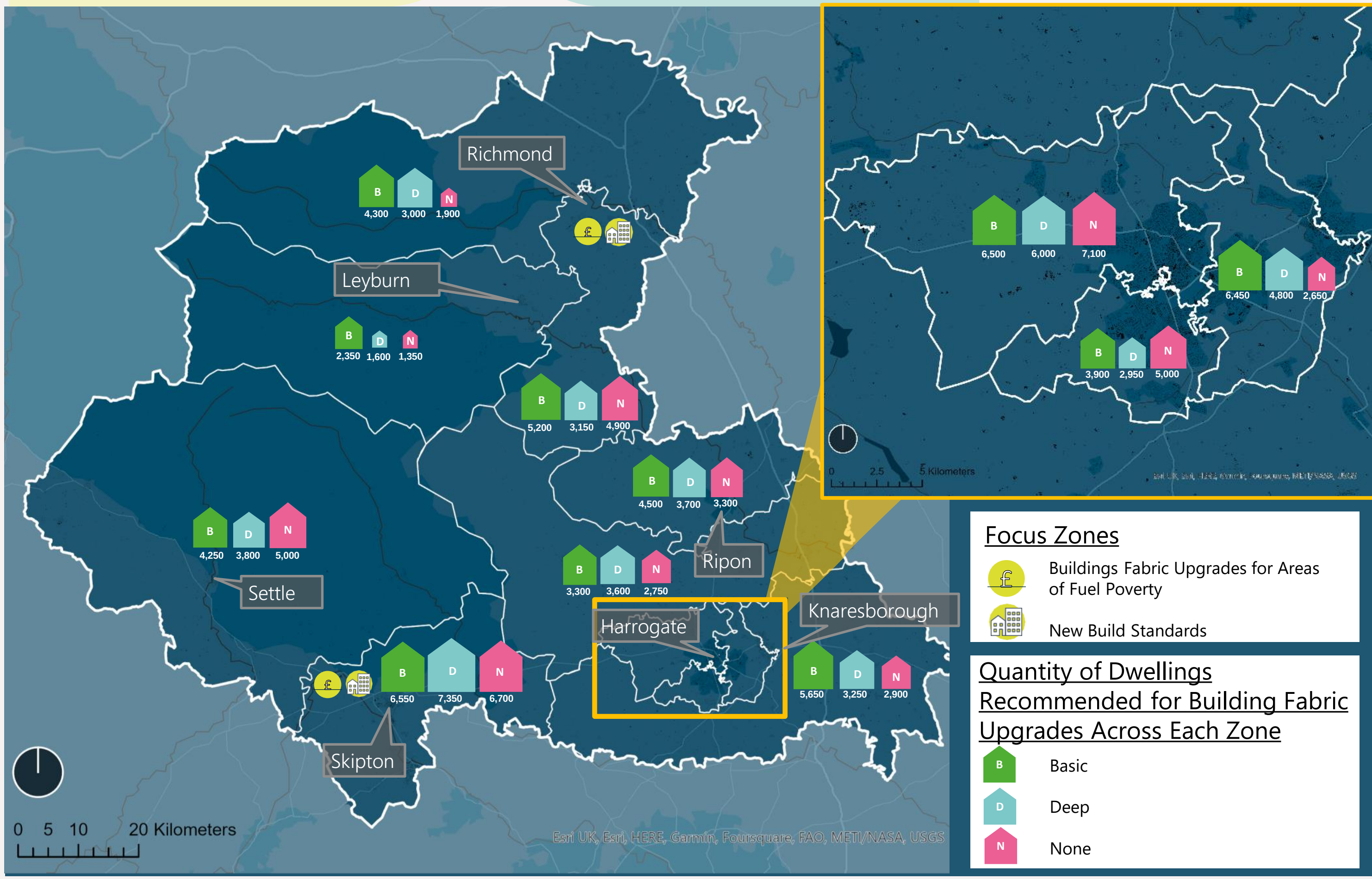
A large proportion of dwellings across the Dales are recommended for building fabric upgrades (retrofit) to meet net zero. This is consistent across all ambition levels, with earlier targets requiring more rapid treatment of homes. The map shows how these building fabric upgrade measures (insulation, glazing and draughtproofing) are likely to be distributed across the region. In total, 71,000 dwellings across Dales are recommended for upgrades at a cost of £450m. Upgrades are split into "basic" and "deep", explained on the following pages.

Prioritising the delivery of building fabric upgrades in areas with high levels of fuel poverty will maximise the impact of bill savings and the health benefits of warmer homes. These priority zones are shown on the map by the '£' symbol. These priority zones are shown on the map by the '£' symbol. Areas with large numbers of new build dwellings planned can prioritise building to net zero standards (e.g. Passivhaus), potentially encouraged a local design code or supplementary planning document.

While this plan outlines the lowest cost path to a net zero energy system, additional deep building fabric upgrades may be desirable to meet other local priorities, particularly fuel poverty alleviation and job creation.

71,000
dwellings (51%) recommended for building fabric upgrades

over
£450m
capital investment in domestic building fabric upgrades required

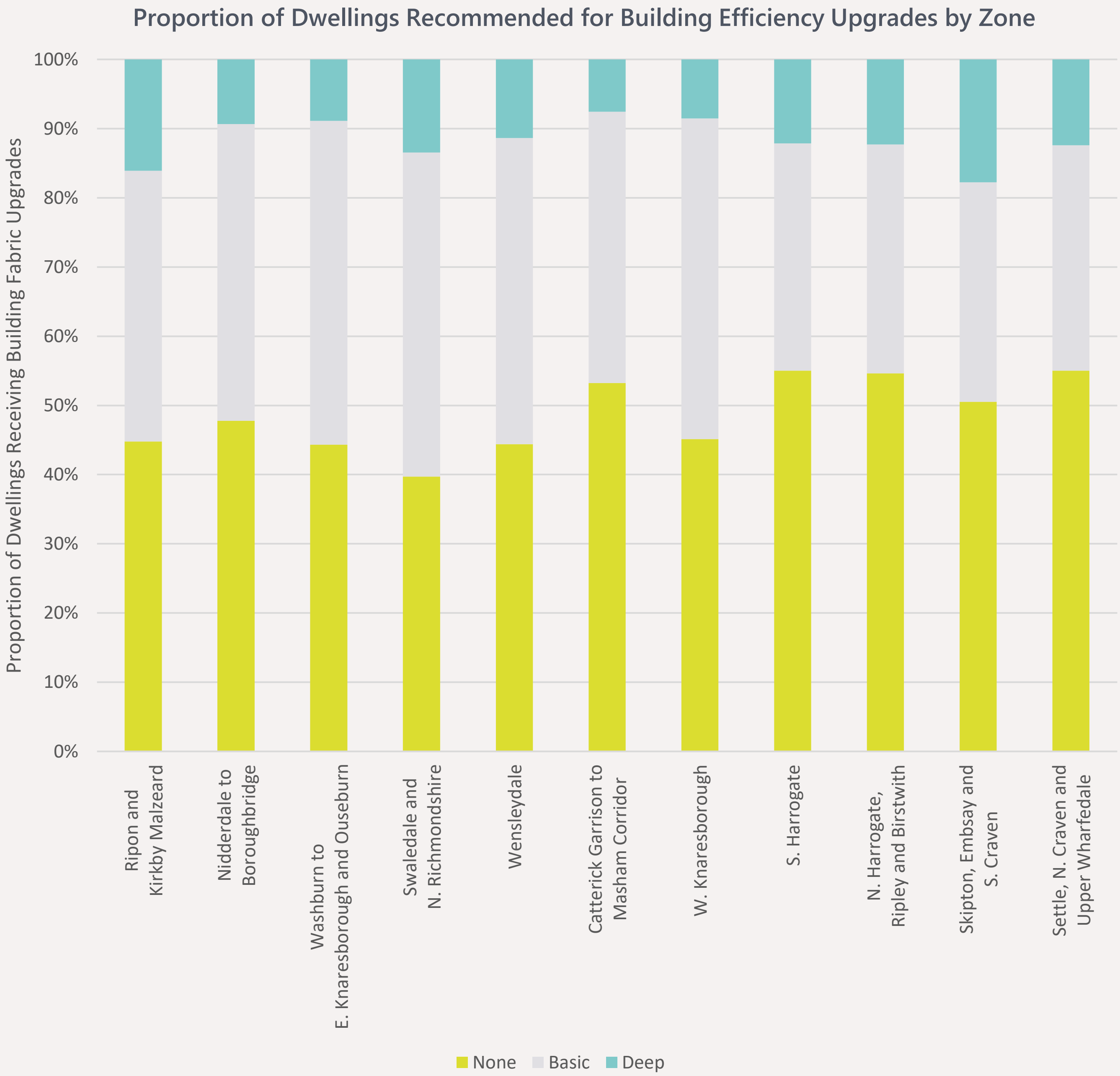


Zones and Dwelling Types

Building fabric upgrades are improvements to the fabric of domestic and non-domestic buildings to reduce heat loss. Upgrades can include draught proofing, loft and cavity wall insulation (referred to here as "basic" upgrades), double or triple glazing, internal or external wall insulation, floor insulation and door upgrades ("deep" upgrades). These measures can improve comfort and health of occupants, reduce bills, and make it easier to transition to low carbon heating systems, whilst also reducing the need to upgrade the electrical network. Since building fabric upgrades can reduce the size and cost of heating system needed, it makes practical sense to complete them before heating system replacements take place, or at the same time to minimise disruption to occupants.

The graph shows the extent of upgrades recommended across each zone, which is influenced by the types of dwelling in each area. Around half of the dwellings in the Dales would require some building fabric upgrades with majority being basic building fabric upgrades. A small portion (less than 10%) receive deep building fabric upgrades.

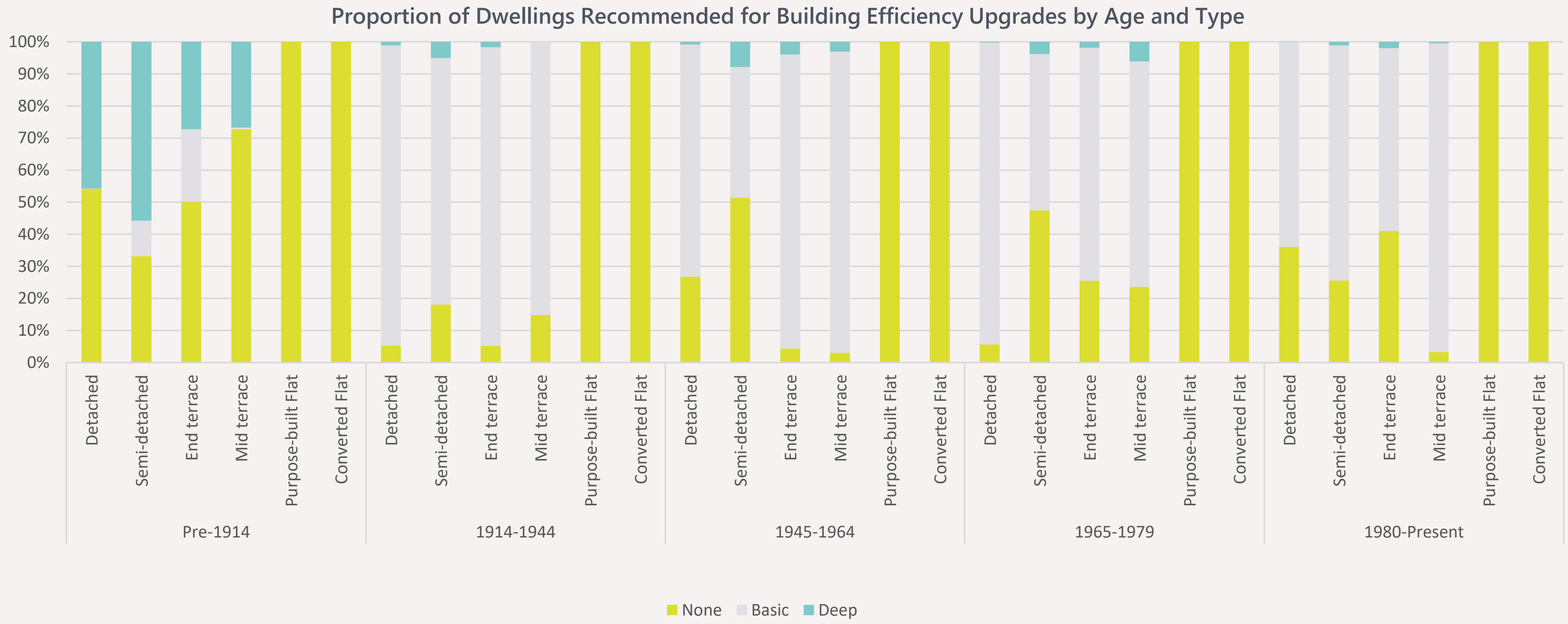
Dwellings which aren't identified for upgrades by cost optimal modelling are not necessarily ruled out from benefiting from upgrades; other factors such as prevalence of fuel poverty, or a focus on health and comfort benefits of dwellings which are easier to keep warm, could drive the decision to go beyond the suggested cost-optimum.



Zones and Dwelling Types

Building age and construction is a major factor in which types of building fabric upgrades are recommended. Basic upgrades are recommended across much of the housing stock built after 1914, as shown in the graph below, whereas older dwellings would require deep upgrades, which can be less cost-effective. This is due to the oldest group of dwellings having been built with solid walls, requiring either internal or external insulation, with cavity walls only becoming the norm from around 1930. Given that terraces are the most common building type of the age bracket with solid walls, these could be tackled on a street-by-street basis, since attempts to insulate single dwellings within terrace rows are likely to be awkward and limited in their effectiveness. Deployment at this kind of scale could also prove vital for achieving acceptable costs, which is a major hurdle for solid wall insulation.

Modern buildings have little potential for cost-effective upgrades, and opportunities for individual flats are limited. While the modelling approach does not identify upgrade opportunities in any type of flat, some types of converted flats may have similar opportunities to houses, though there may be a need for multi-stakeholder buy-in. Purpose-built flats such as multistorey blocks will tend to require whole-building approaches.



Focus Zones

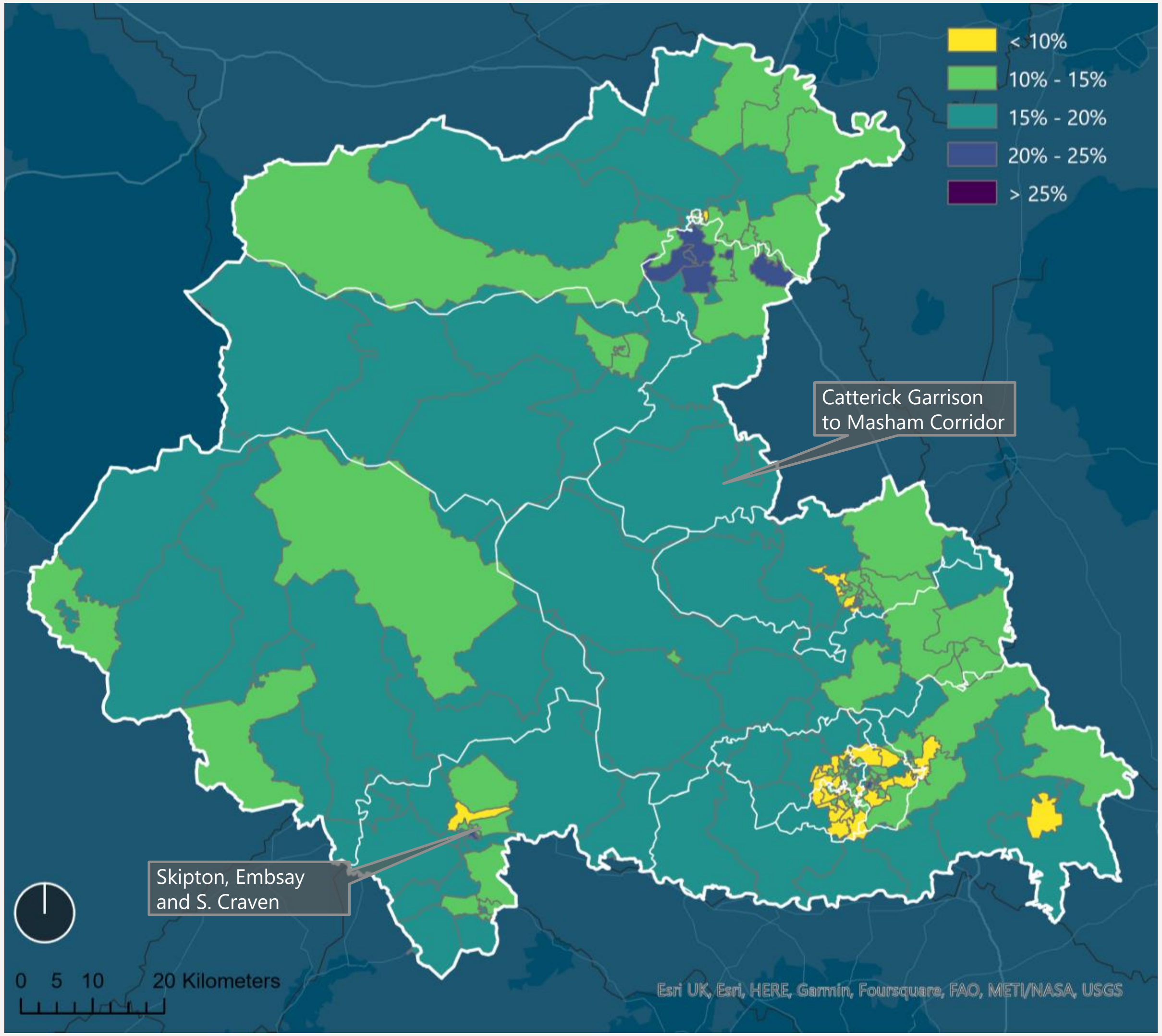
Focus zones highlight areas where particularly large numbers of a certain solution are recommended, directing efforts towards delivery at scale in that zone. Focus zones can account for factors such as the socio-economic conditions in an area, network capacity, or characteristics of the building stock. These could bring specific advantages, learning opportunities or challenges to delivery in that location.

Catterick Garrison to Masham Corridor

Across the whole area dwellings built between 1945-1965 (~2,100) will require the highest uptake of basic building fabric upgrades. Semi-detached buildings (~800) make up the majority of dwelling types. Deep building fabric upgrades are predominately limited to pre-1914 houses, across the housing types. A particular focus is the area which extends from the town of Richmond to Catterick Garrison where we see high levels of fuel poverty (>25% of dwellings).

Skipton, Embsay and S. Craven

This is a region of high fuel poverty, with areas around Skipton having fuel poverty levels above 25%. Around 2,300 dwellings built between 1945-1965 will require building fabric upgrades, again with semi-detached dwellings (nearly 1,000) making up the majority. Deep building fabric upgrades are mostly in pre-1914 dwellings, particularly terraced dwellings.



Fuel poverty in the Dales area

Heating

Overview

Gas boilers make up the majority of heating systems in dwellings (91%) and non-domestic buildings, with fossil fuel use in buildings accounting for 22% of emissions in the Dales (excluding industry). To reach net zero, these will need to be replaced with low carbon heating systems. Heating systems can be replaced at their natural end-of-life, however supply chain capacity and household awareness will need to be built ahead of time to ensure low carbon options are available, straightforward and attractive when replacements occur, which can often be during a break-down. The sale of new fossil fuel heating systems would need to end by 2025 to meet a 2040 net zero target in order to minimise premature replacements of boilers (based on a 15 year lifespan). This is significantly more ambitious than any cut-off date likely to be imposed by central government, with 2035 currently being considered*.

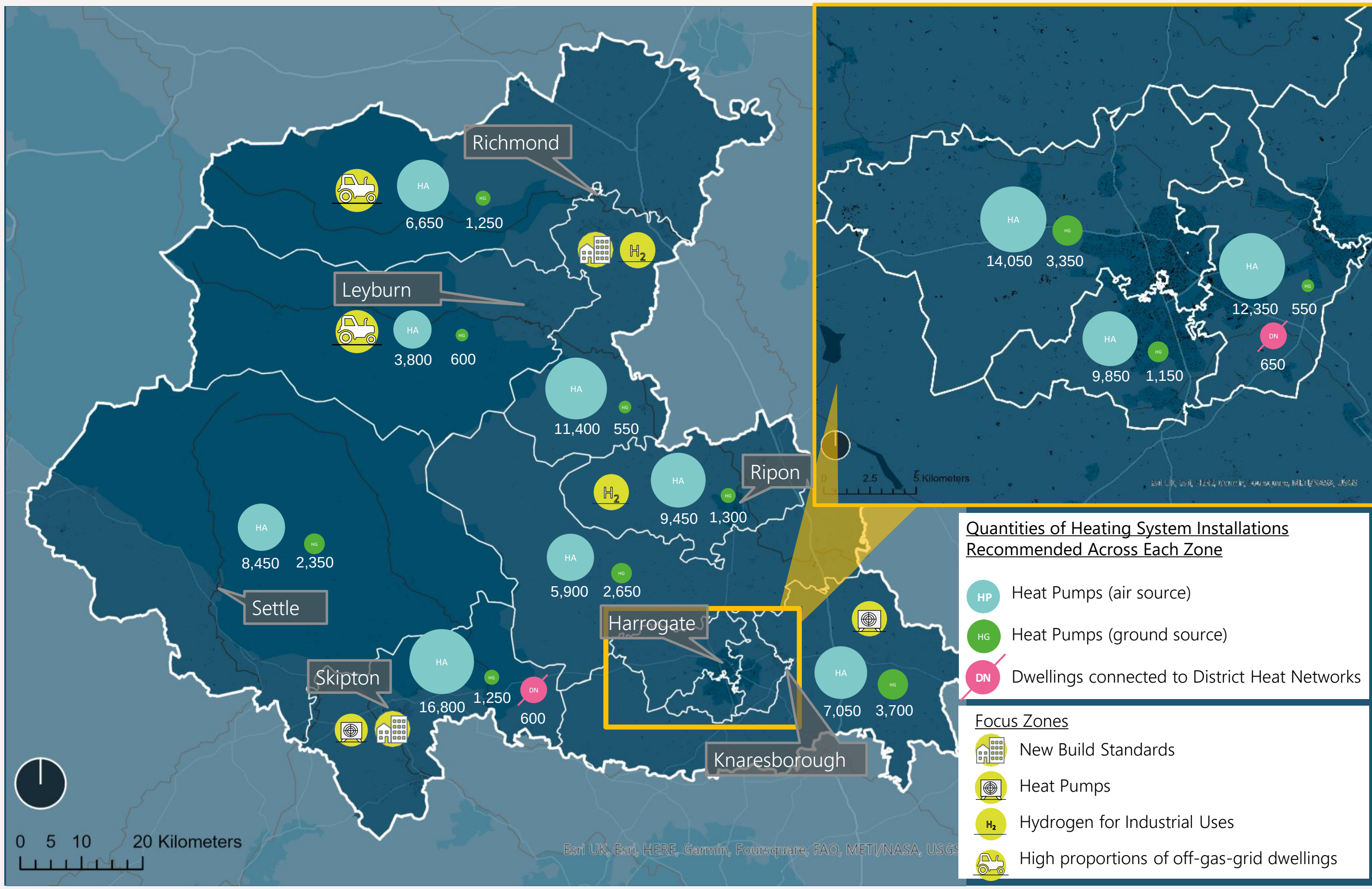
Heat pumps are the widely most suitable technology for decarbonising heating within the Dales, with growing evidence** that they can be installed in the full range of property archetypes. Heat networks can serve dense town centre locations (supported by some existing electric resistive heating). Holiday homes which see low occupancy in winter may be more cost-effectively decarbonised with resistive heating, rather than more expensive technology with lower running costs like heat pumps.

Rural zones off the gas grid are low regret for heat pumps, with an end to new fossil heating installations for these dwellings set for 2025. There may be opportunities to use hydrogen for heating dwellings near industrial users of hydrogen. Areas with large numbers of new build dwellings planned can prioritise building to net zero standards, avoiding the costlier need to upgrade building fabric later.

122,000 **dwellings recommended for heat pump installations**

1,500 **dwellings recommended for connection to district heat networks**

c.£900m **capital investment in domestic heating systems required**



* https://www.gov.uk/government/publications/heat-and-buildings-strategy

** https://es.catapult.org.uk/news/electrification-of-heat-trial-finds-heat-pumps-suitable-for-all-housing-types

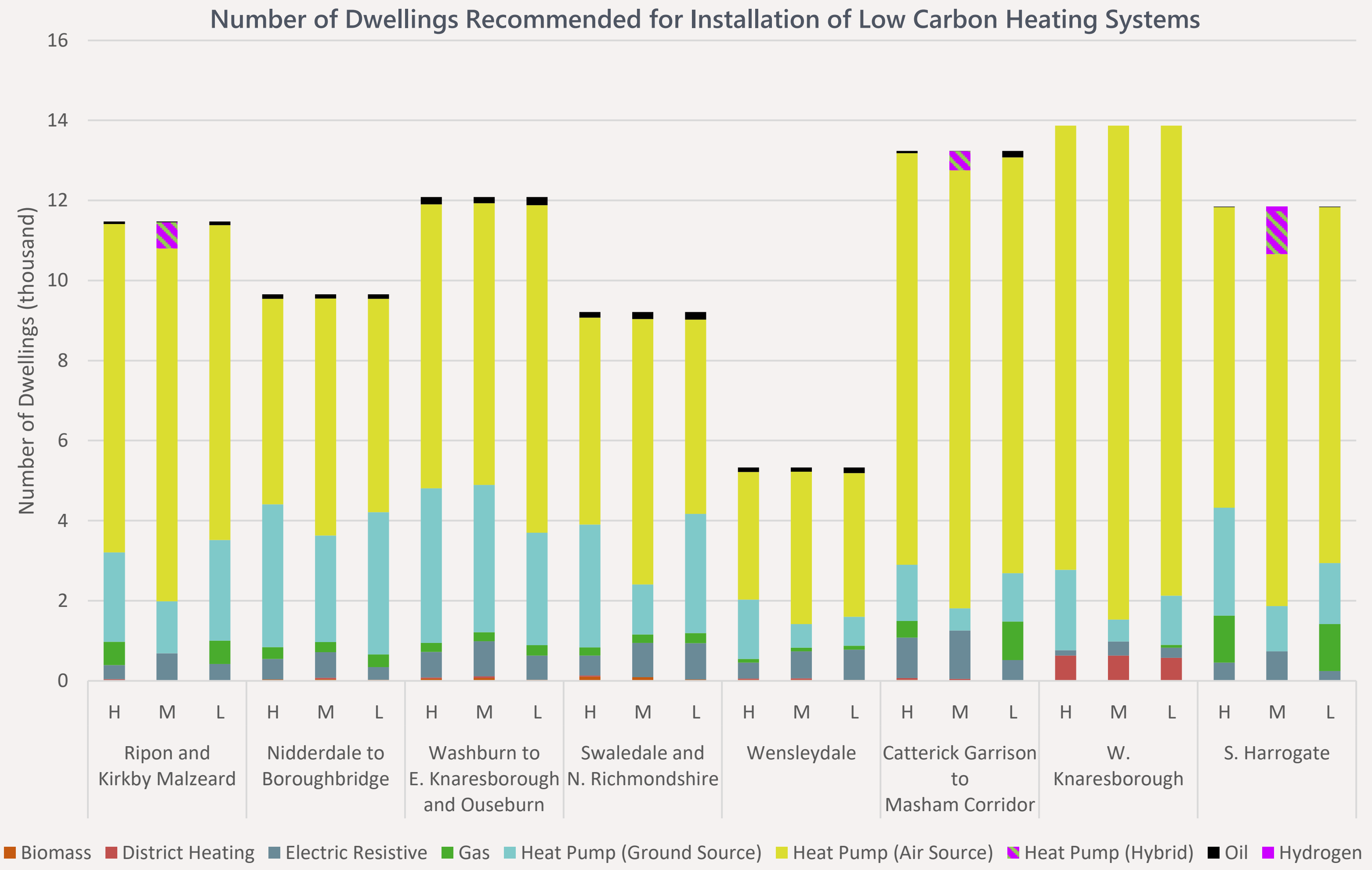
Domestic Buildings

The most suitable choices of heating systems for each zone are largely consistent between different levels of ambition for the net zero target date, with only slight variation in places as shown in the chart. This indicates that choices of heating system are mostly low regrets. Where variation is seen, the case for picking one technology over another is more marginal, suggesting that either option would be sound, and local factors and preferences can drive the decision.

In particular, ground source heat pumps are advantageous over air source in some properties for the high ambition 2030 target, but this tilts towards air source for the medium ambition 2040 target, suggesting either option would be a good fit. A very small number of hybrids using air source heat pumps and hydrogen boilers together could be beneficial near industrial uses of hydrogen, but again this is shown as a marginal option, only appearing in certain scenarios. Small quantities of oil consumption remain in the modelled pathways, due to assumptions about the practicalities of replacing oil usage in certain types of dwellings, such as large houses and listed buildings. For these cases, alternatives such as biofuels could be explored. It may also be found that these uses can be electrified.

Due to the rural nature of the Dales, district heating is likely to make a very small contribution to heating overall.

The most suitable choices of heating systems for each zone are largely consistent between different levels of ambition for the net zero target date, with only slight variation in places as shown in the chart. This indicates that choices of heating system are mostly low regrets. Where variation is seen, the case for picking one technology over another is more marginal, suggesting that either option would be sound, and local factors and preferences can drive the decision.

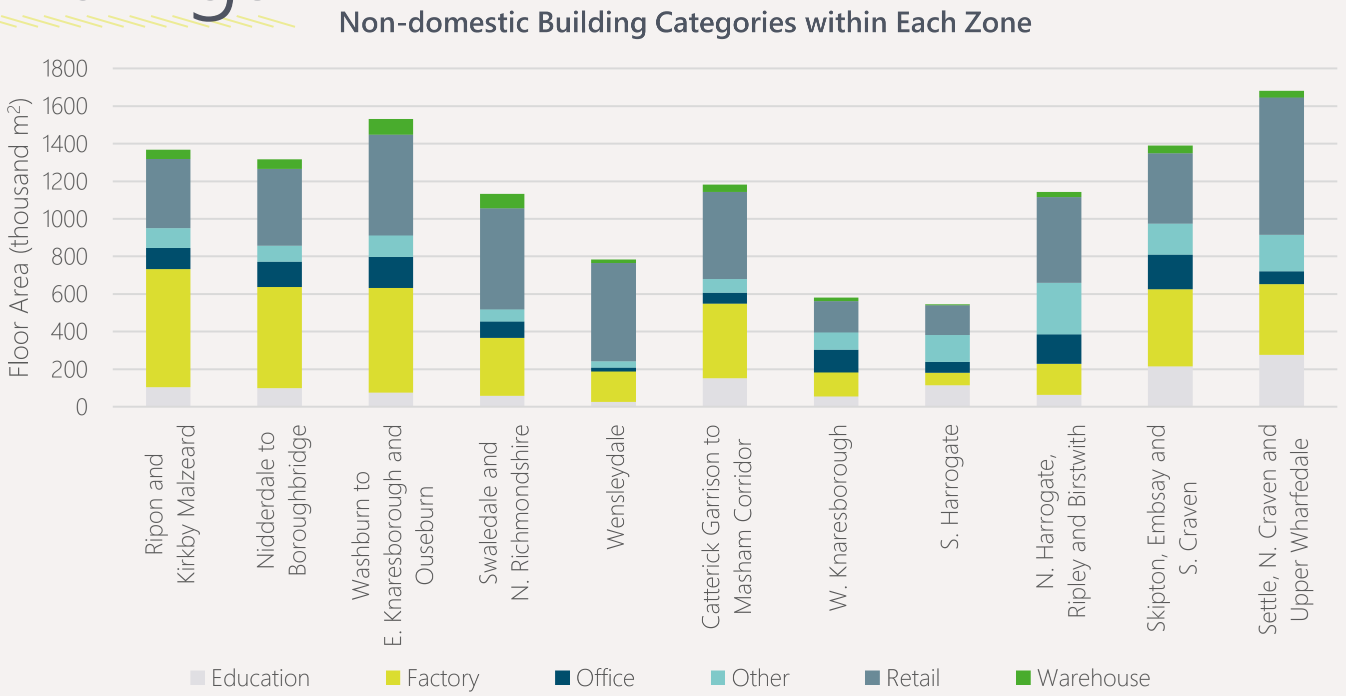


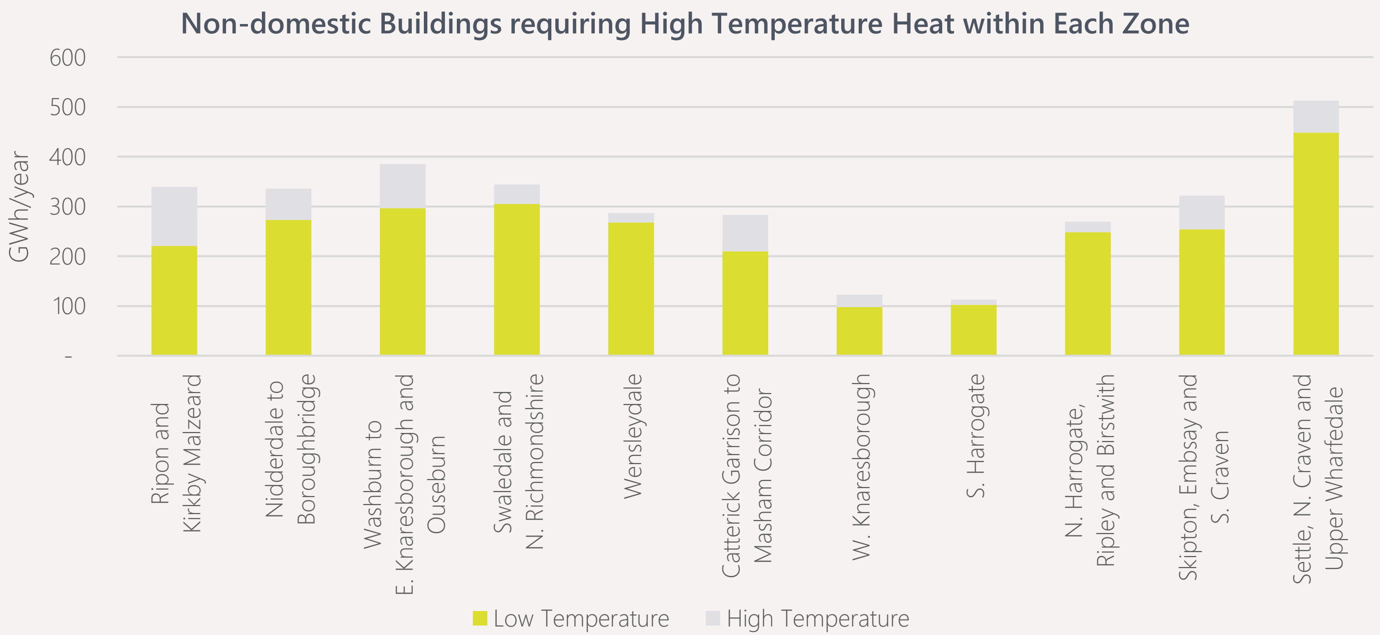
Scenario Key
H – High Ambition: 2030 net-zero target
M – Medium Ambition: 2040 net-zero target
L – Low Ambition: 2050 net-zero target

Non-Domestic Buildings

Non-domestic buildings are categorised into a range of uses, shown in the chart to the top right. Much of the demand for heat in non-domestic buildings is low temperature heat for providing space heating and hot water to buildings, with similar decarbonisation options as domestic buildings. However, a small portion of heat is likely to be required at high temperature for specialised industrial processes, as shown on the chart to the bottom right.

High temperature heat is likely to be more difficult to electrify or provide with district heating, making a stronger case for hydrogen to replace fossil fuels for these applications. In the modelled pathways, hydrogen isn't assumed to be available until the mid-2030s at the earliest, meaning that the high ambition scenario is unable to decarbonise high-temperature processes in time for the target, while the medium ambition scenario would require significant planning and rapid deployment for hydrogen becoming available shortly before the net zero target date. However, earlier decarbonisation of these processes could be achieved with local electrolysers to produce hydrogen in the absence of a pipeline supply.

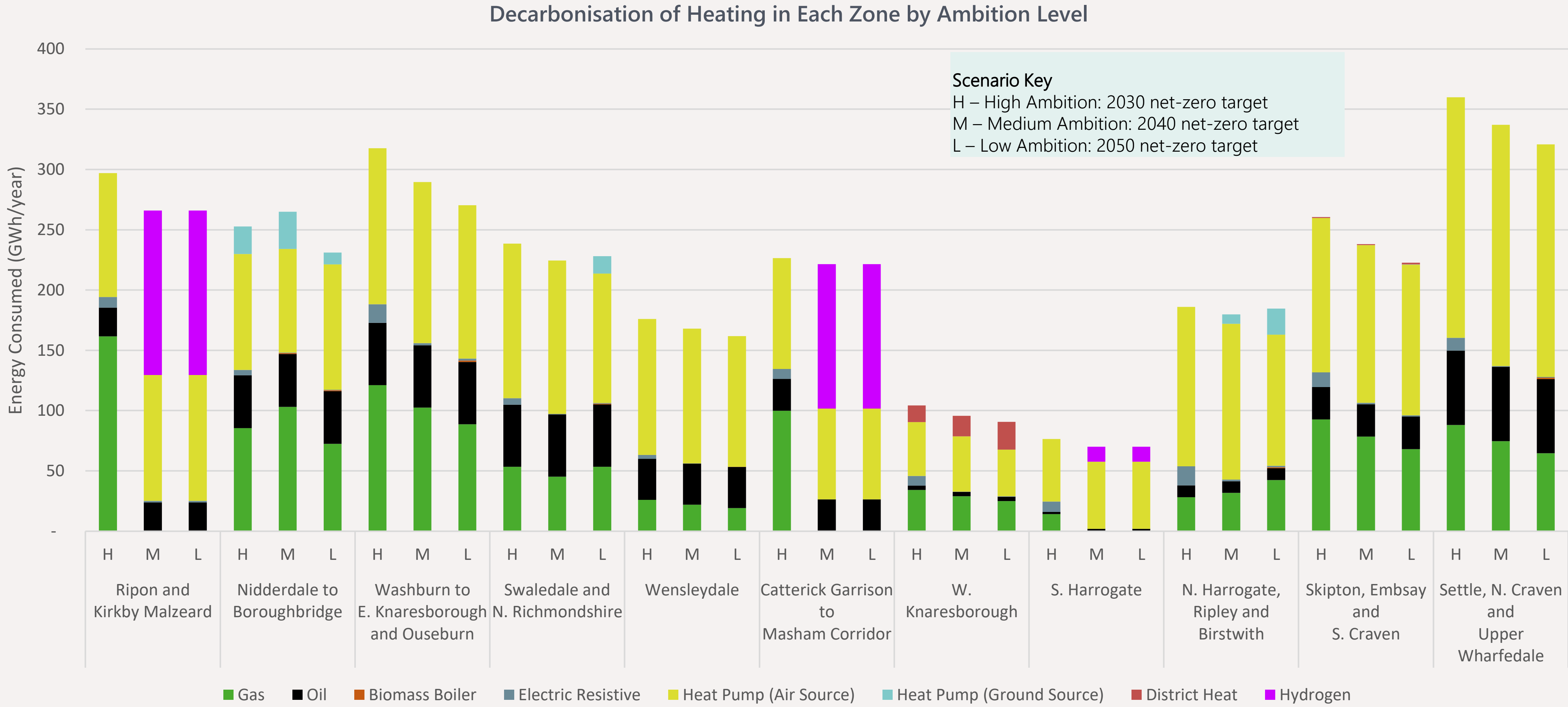




Non-Domestic Buildings

The decarbonisation of low temperature heat, used to provide space heating and hot water in non-domestic buildings, follows a similar pattern to domestic decarbonisation, with much of the fossil fuel systems being replaced with heat pumps, or by connecting to district heat networks in town centres. Building fabric upgrades are bundled with the heating system upgrades shown here, and other efficiency measures such as recommissioning and upgrades of building management systems, LED lighting and lighting control can be implemented at the same time, often improving the economics of the project.

Gas consumption for high temperature processes remains mostly unconverted, likely due to the poor cost-effectiveness of converting the gas network to hydrogen in rural areas. In practice, these industries could produce hydrogen on site using decentralised electrolysers, avoiding the reliance on network conversion to decarbonise. Significant quantities of oil consumption remain in the modelled pathways, due to assumptions about the practicalities of replacing oil usage on farms. For these uses, alternatives such as biofuels could be explored. It may also be found that these uses can be electrified, similarly to off-gas-grid dwellings.

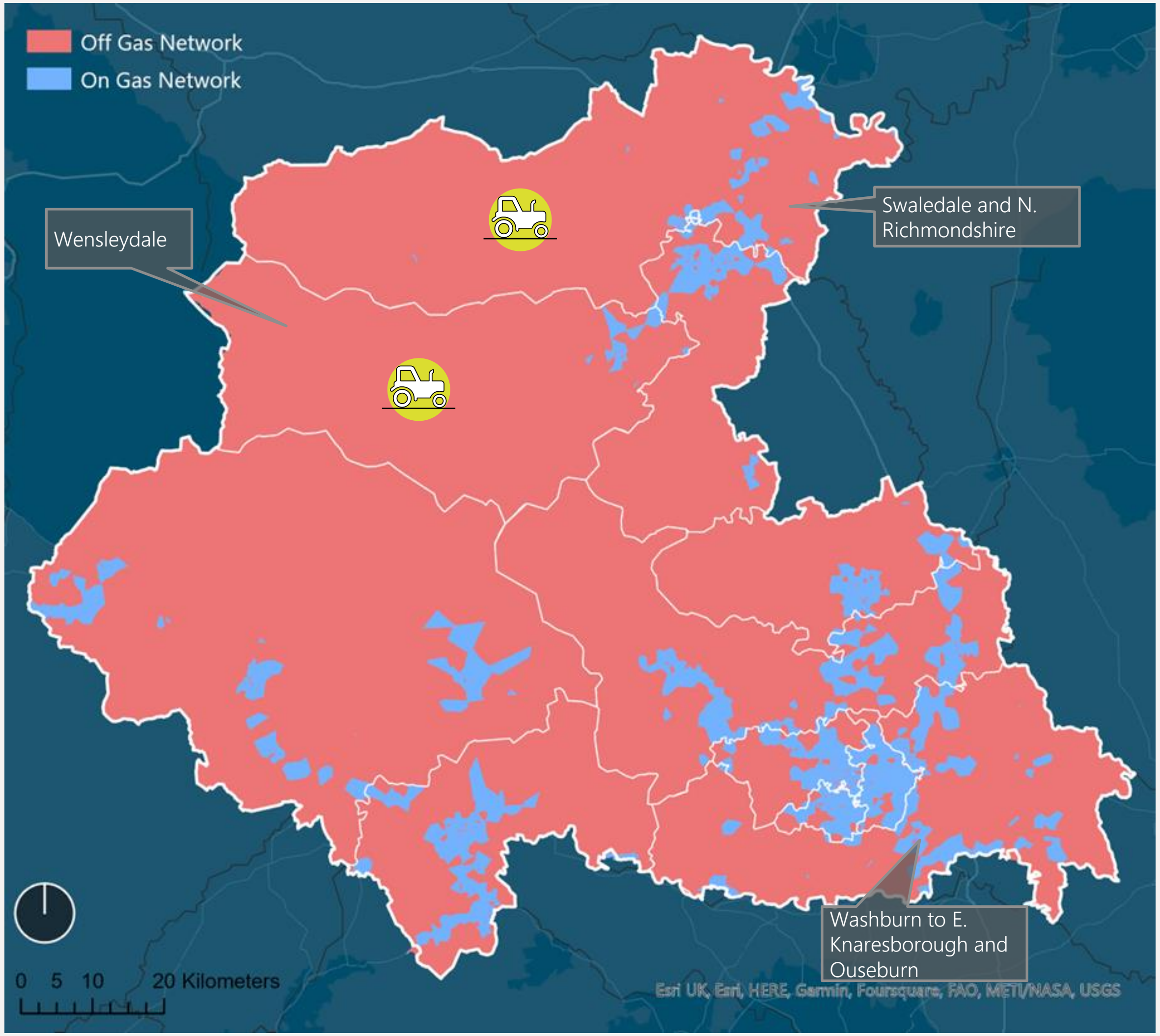


Rural Focus Zones

The Washburn to E. Knaresborough and Ouseburn zone, the Swaledale and N. Richmondshire zone & the Wensleydale zone have the largest number of homes which are not connected to the gas grid (4,850 (46%) 4,600 (50%), and 3,800 (74%) respectively). The government's Heat and Buildings Strategy proposes to end the installation of fossil-fuelled heating systems in off-gas dwellings from 2026, meaning rural properties will decarbonise in an earlier wave than most of the housing stock.

With no gas network to carry hydrogen, or dense areas of dwellings to make a heat network financially viable in rural zones, it is very likely that heating will be electrified, making them low regrets for heat pump installations. The Washburn to E. Knaresborough and Ouseburn zone and the Swaledale and N. Richmondshire zone have substantial spare capacity in the electrical distribution network, meaning they should be able to commence with significant numbers of heat pump installations before encountering capacity constraints.

When installing a low carbon heating system, it's advisable to carry out any basic building fabric upgrades at the same time, or beforehand, to avoid needlessly oversizing the new heating system or incurring high running costs. The current requirement to qualify for the government's Boiler Upgrade Scheme (open till April 2025) is that there is no outstanding recommendation for loft or cavity wall insulation in the building's energy performance certificate (EPC)*.



Areas with and without coverage from the gas grid

Zones with high proportions of off-gas-grid homes

* https://www.gov.uk/guidance/check-if-you-may-be-eligible-for-the-boiler-upgrade-scheme-from-april-2022

Heat Pump Focus Zones

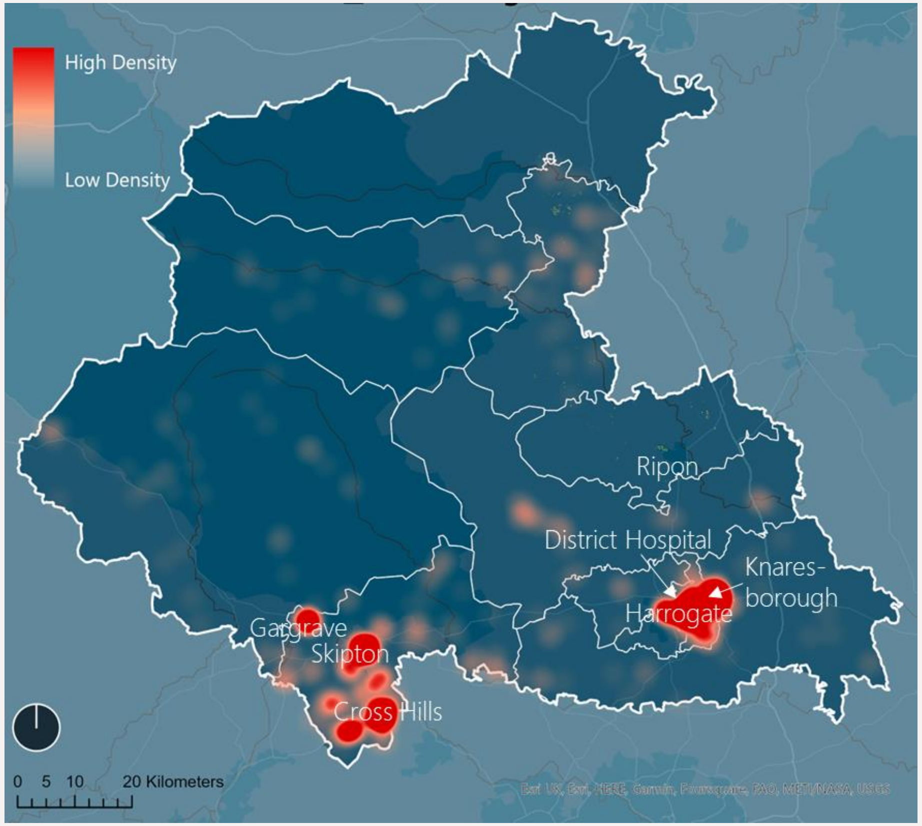
Example area of high uptake of ground source heat pumps in the N. Harrogate, Ripley and Birstwith zone

The W. Knaresborough zone, the N. Harrogate, Ripley and Birstwith zone and the Skipton, Embsay and S. Craven zone have the largest roll-out of air source heat pumps (12,350, 14,050 and 16,800 respectively). This will require significant supply chain scale-up, citizen awareness and buy-in, and attractive commercial offerings to compete with existing fossil fuel options.

Spare capacity in the electrical distribution system is very limited in the W. Knaresborough zone & the N. Harrogate, Ripley and Birstwith zone, meaning heat pump roll out can commence but will soon encounter network constraints requiring capacity upgrades. In simple terms, there could be enough capacity today for around 1,600 new heat pumps in the W. Knaresborough zone and 2,200 in the N. Harrogate, Ripley and Birstwith zone (not accounting for the impacts of electric vehicles and removal of old electric heaters).

The Skipton, Embsay and S. Craven zone has substantial spare capacity, allowing much more progress to be made (capacity for around 12,000 typical heat pumps, not accounting for EVs and electric heater removals). The Washburn to E. Knaresborough and Ouseburn zone and the Swaledale and N. Richmondshire zone have the most spare capacity, and with 10,700 and 7,900 heat pumps to be installed respectively, these zones would make good heat pump focus zones from an infrastructure perspective.

District Heat Networks



Density of buildings recommended for connection to district heat network in medium ambition scenario

Heat supplied through underground pipes from a centralised energy centre or a network of decentralised energy centres tends to be the most suitable solution for denser urban zones, particularly where there are large numbers of dwellings that require building fabric upgrades to make them suitable for heat pumps, which is either too expensive or impractical. Heat networks cause less disruption in dwellings during installation compared to some other options, though there are wider considerations such as traffic disruption during pipe laying, and space restrictions in city centres.

West Harrogate and Knaresborough, and Skipton, Gargrave and Cross Hills are likely to be viable for district heating schemes, serving over 1,300 homes in these zones. The Harrogate District Hospital could be a suitable starting point for a heat network, having an energy centre with a heat pump serving the hospital site already.

Beyond the areas identified by the cost optimisation scenario modelling, the density of buildings in Central Harrogate and Ripon make these areas worth assessment for further heat network development. 10,500 dwellings within Central Harrogate and 6,600 in Ripon are in an area which could be viable for heat networks. If developed, these networks would take the place of other heating system options shown in this plan in these areas, primarily individual heat pumps.

Wastewater treatment plants (such as the site to the north of Bilton in Harrogate), distilleries, paper mills, bakeries and supermarkets can potentially supply waste heat to district heat networks, improving the cost effectiveness and carbon credentials of the heating delivered.

Zone	No. Homes Connected	Domestic Peak Demand (MW)	Non-domestic Peak Demand (MW)	Total Peak Demand (MW)
W. Knaresborough	632	3.7	6.9	8.9
Skipton, Embsay and S. Craven	640	2.4	0.3	2.7

All the areas identified sit on a moderately productive aquifer** which may be suitable to provide low carbon heat for heat networks.
The Green Heat Network Fund* will have quarterly application rounds from March 2022 until 2025, and could provide funding

* https://www.gov.uk/government/publications/green-heat-network-fund-ghnf
**http://mapapps2.bgs.ac.uk/geoindex/home.html?layer=BGSHydroMap&_ga=2.227016797.1726030392.1645026282-782257203.1645026282

Figures shown are based on the medium ambition scenario. Total peak demands are lower than the sum of domestic and non-domestic peaks, as they will not fully coincide in time

Heat Network Starting Point

Harrogate Centre

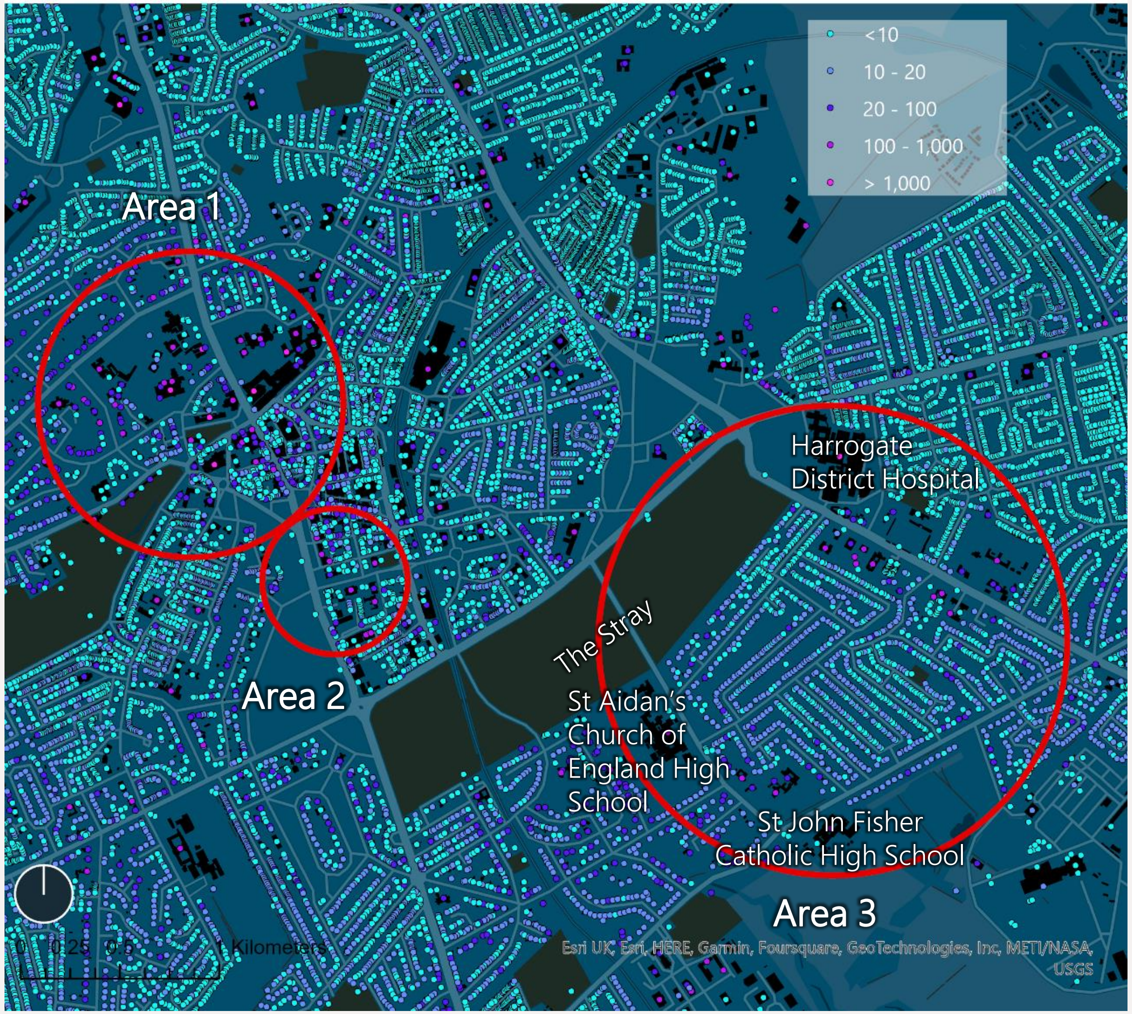
Area 1 which is situated around the Turkish baths in Harrogate includes a number of hotels, holiday and short-let accommodation, cinema and exhibition centres, as well bars, nightclubs and restaurants. Dual use buildings which are commercial and residential, contribute to nearly 30% of the non-domestic demand in the area. Flats account for the majority (82%) of domestic dwellings.

Area 2 which is centred around West Park and Victoria Avenue, houses a large number of dual use buildings, hotels, offices and shops. These account for over 60% of non-residential demand. Flats account for nearly 75% of the residential demand in this area.

Area 3 extends down and out from Harrogate District Hospital. The majority of dwellings are detached and semi-detached, account for ~40% of the residential heat demand each. Shops and hospitals take an equal share of 50% of the non-residential demand with secondary schools (13%) and nursing homes (10%) also being a major demand.

The mixture of domestic and non-domestic buildings allows for more of a balanced load across the network at any given time. Nevertheless, anchor loads (such as large schools, hospitals, leisure centres) with a steady and constant heat requirement should be sought if possible. Some examples of potential anchor loads are labelled on the map.

The table to the right shows the split of domestic and non-domestic properties and the peak demands. (Note: peaks are not additive as domestic and non-domestic peaks will not occur at the same time).



Harrogate centre heat demand per year (MWh/year)

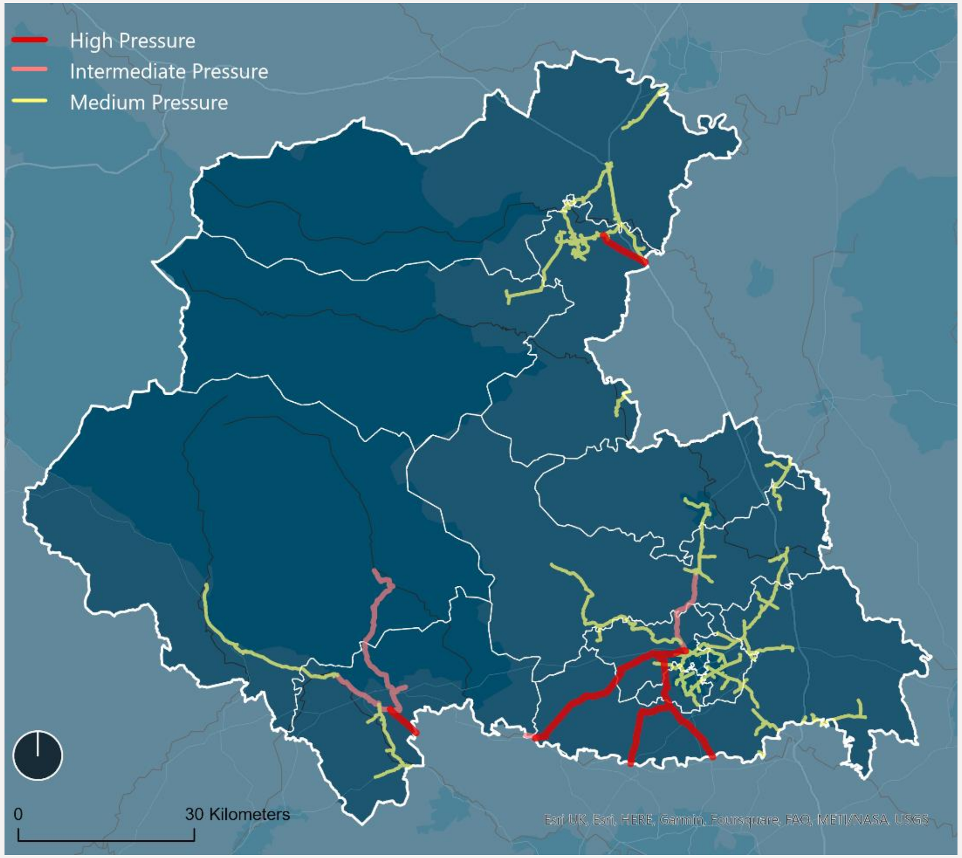
	Number of Domestic Dwellings	Number of Non-Domestic Properties	Total Peak Demand (MW)
Area 1	1,222	870	19.1
Area 2	202	312	3.5
Area 3	1,647	165	9.6

Gas Network

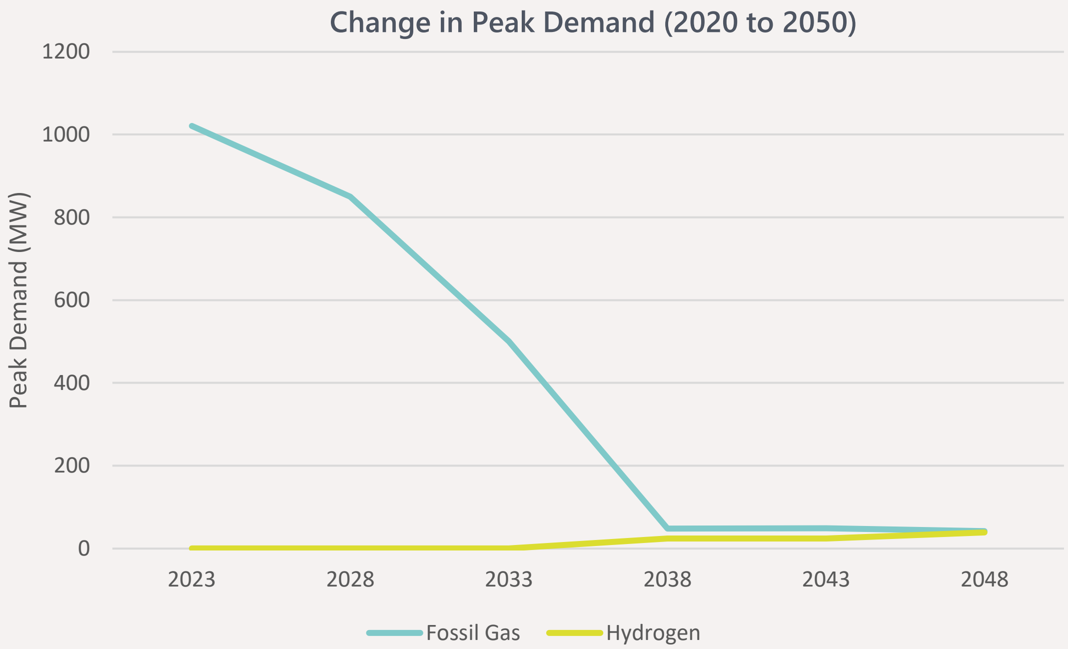
The gas network in the Dales is operated under license by Northern Gas Networks and currently supplies fossil gas to the majority of dwellings in the Dales (extents of the high-pressure network shown in the map). It is used predominantly for domestic heating, hot water and cooking, but also supports a range of non-domestic and industrial local energy demands.

The current total fossil gas consumption across the Dales is around 1,535 GWh per year. Meeting the net zero goal would mean a steep decline in fossil gas consumed across the Dales, illustrated in the graph below (based on following the 2040 net zero pathway).

Meanwhile, parts of the gas network could be repurposed to supply hydrogen around industrial areas – this is detailed on the following page.



Map of the existing gas network in the Dales



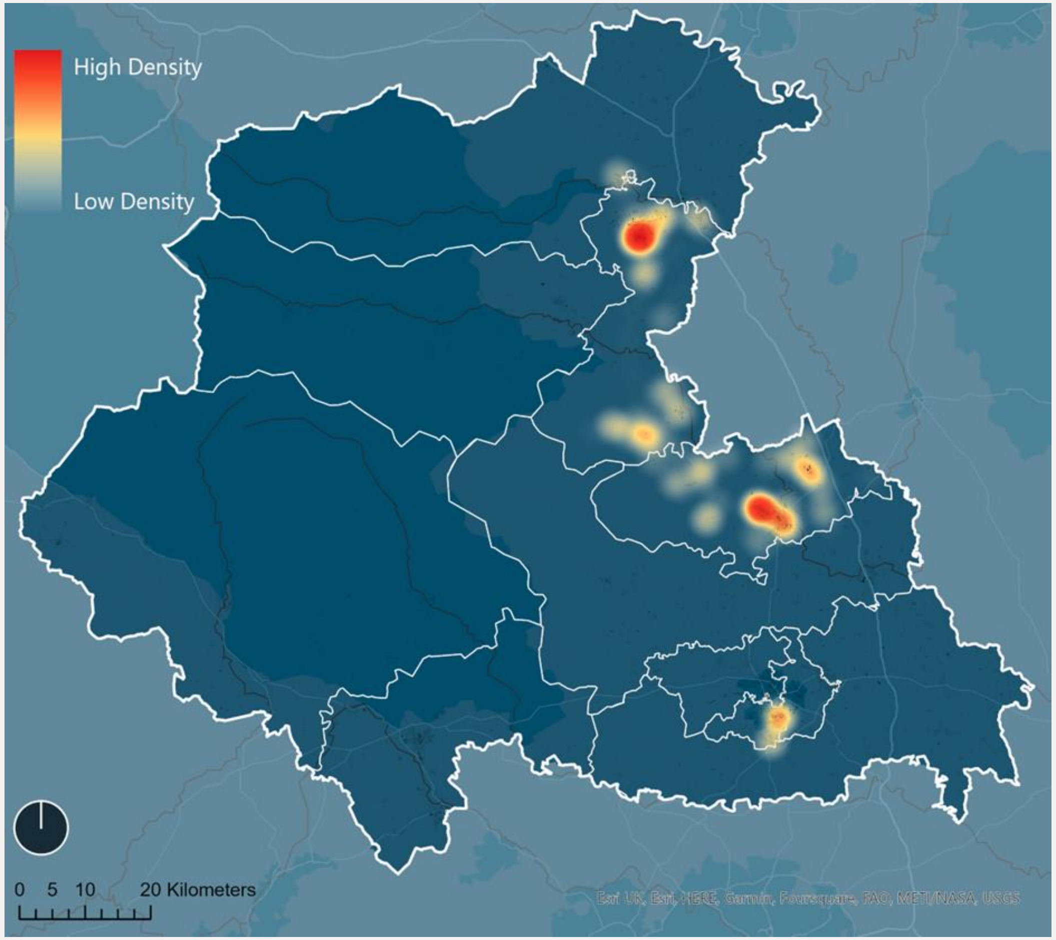
Hydrogen

It is assumed that hydrogen will become available from a converted gas network in the mid-2030s under the H21 scheme*, and therefore cannot contribute to a 2030 net zero target. Even by 2040, the use of hydrogen for building heating is likely to be minimal, as the cost and carbon intensity of hydrogen** are less favourable than for electrification of heat.

However, there are uses of fossil gas in industry for high temperature processes that would be difficult to electrify, and this is where hydrogen could be usefully deployed. Once these industrial clusters are supplied by hydrogen, it could make sense for nearby buildings, including any homes in the area, to also be heated by hydrogen, avoiding the disruption, upfront cost and space requirements of heat pump installation. This could be valuable in dwellings such as terraces where space for heat pump equipment is constrained. There are two main areas of hydrogen used for non-domestic buildings around Catterick and around Ripon.

Areas with high-temperature industrial processes which are unlikely to be reached by a hydrogen network could investigate the use of electrolysers to produce hydrogen on-site. Such electrolysers could form central supplies for a small cluster of nearby users of hydrogen, as shown in the map.

Recognising that there is uncertainty associated with the availability, cost and carbon projections used for hydrogen, near-term focus should be centred on the identified heat pump and district heat network focus zones, keeping options open for areas outside the focus zones. The UK government is expected to clarify its strategy on the use of hydrogen for heating buildings in 2026, which will give a steer on the decisions for these areas.



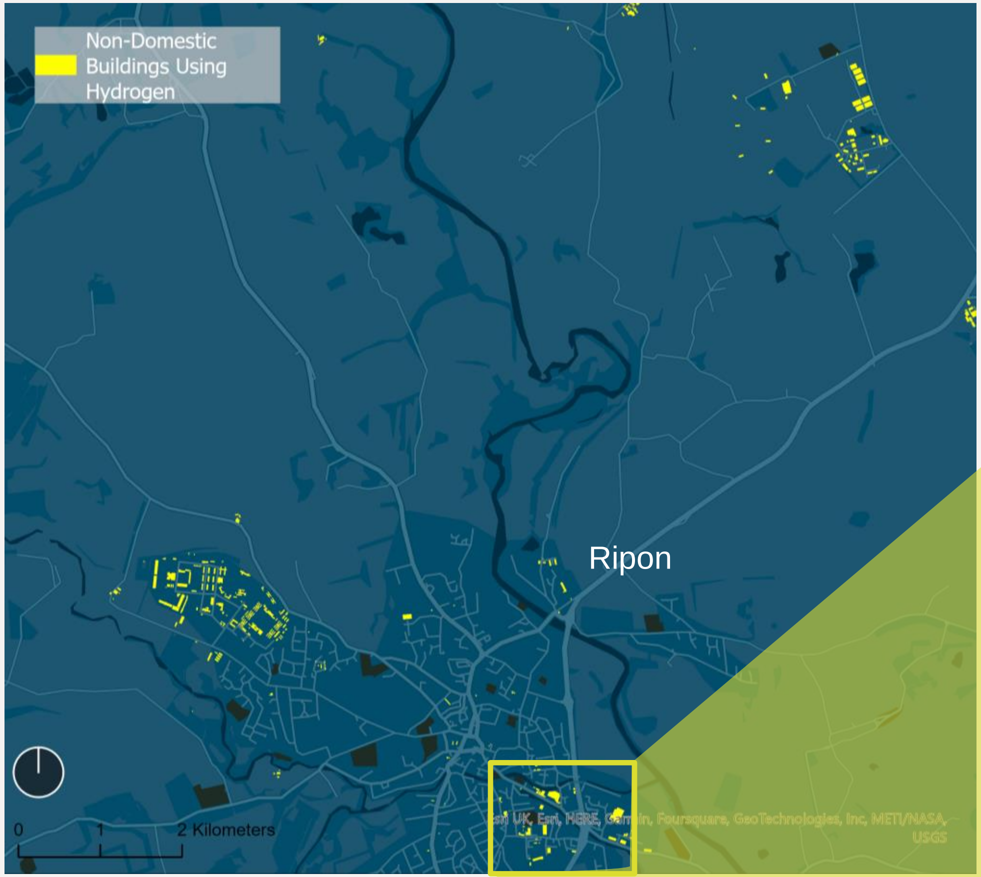
Use of hydrogen for high-temperature industrial processes.

- https://h21.green/about/

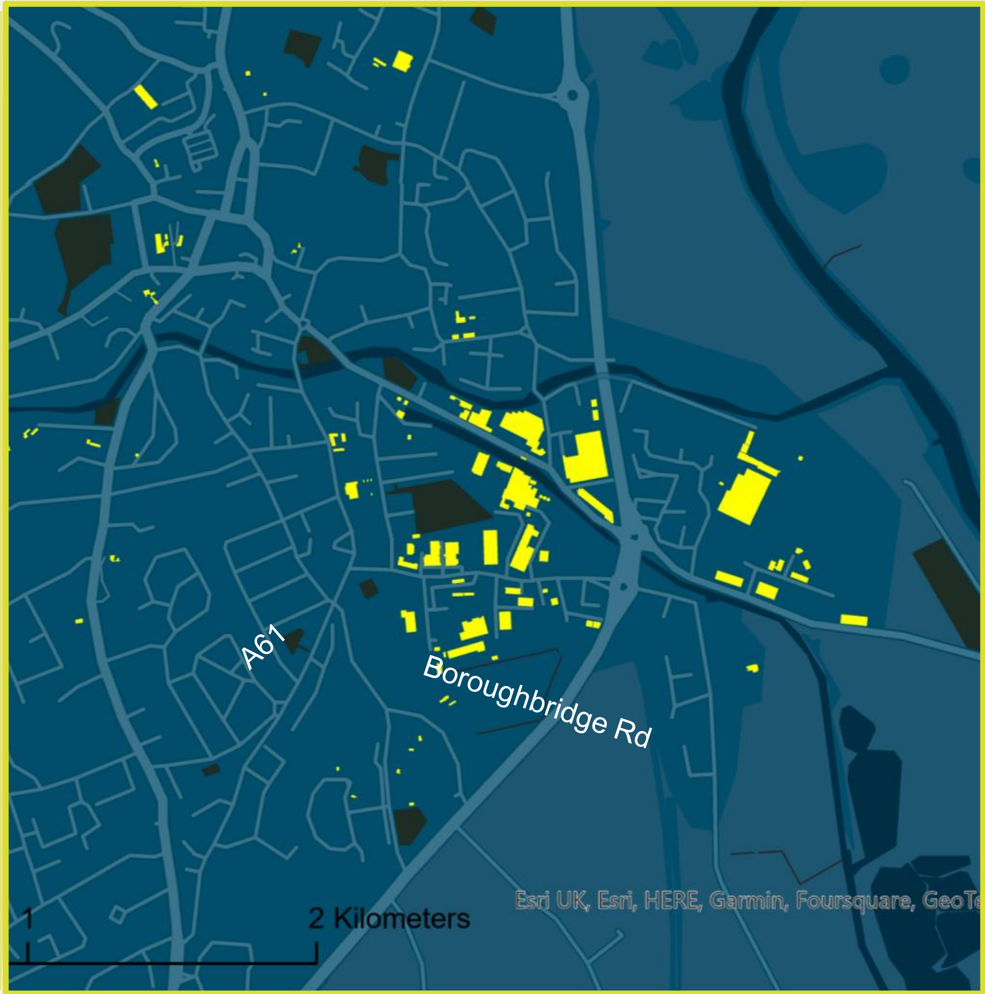
** Hydrogen production cost based on BEIS figures
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011506/Hydrogen_Production_Costs_2021.pdf

Carbon intensity based on the East Coast Hydrogen Feasibility Report
https://www.nationalgrid.com/gas-transmission/document/138181/download

Hydrogen



Towards the south east of Ripon, around the Ripon bypass, there are a number of non-domestic sites proposed for hydrogen use. Given the proximity of these sites to residential buildings, there would be the potential to extend the use of hydrogen into these homes for heating.

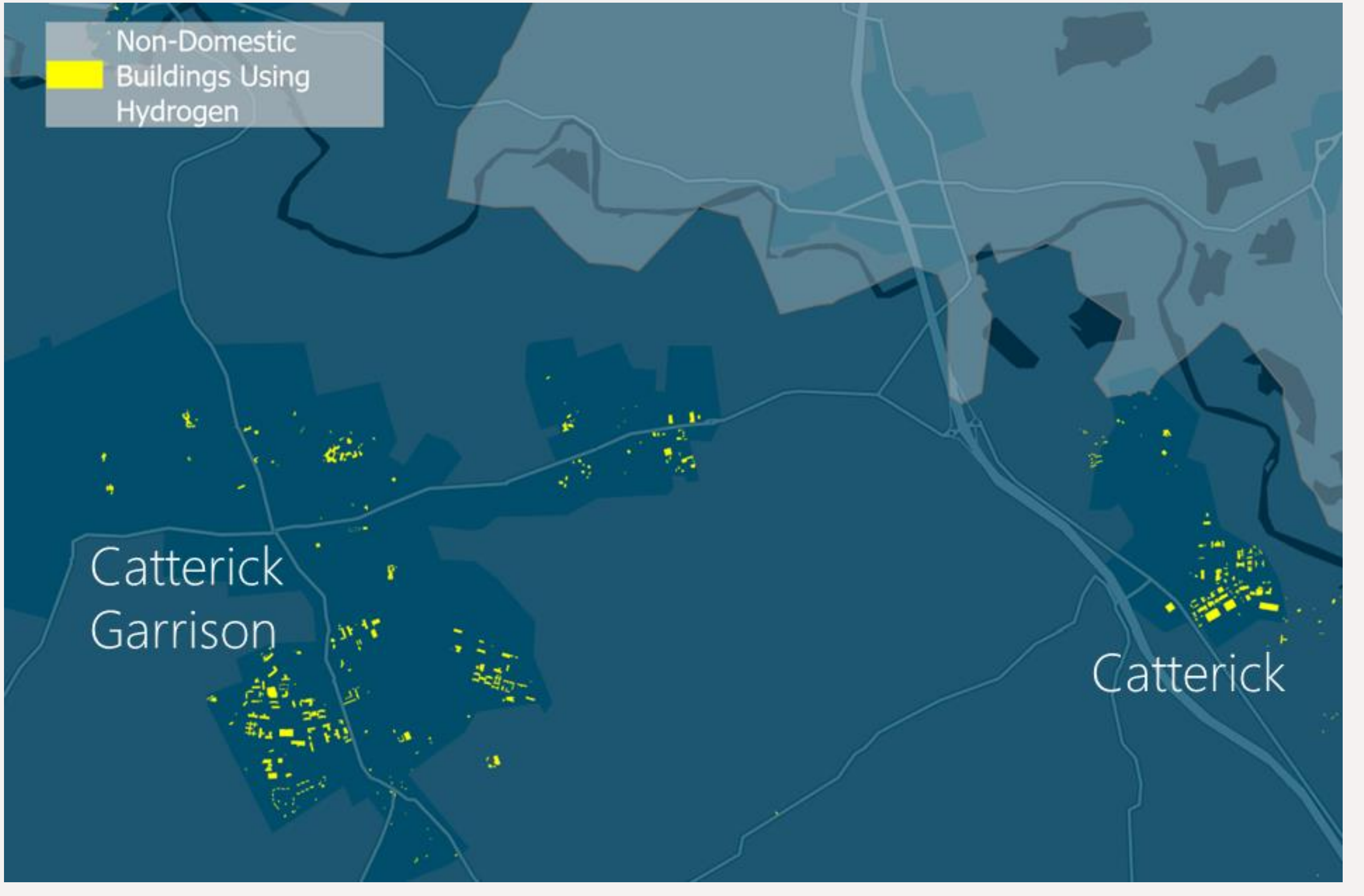


Hydrogen

The Catterick Garrison to Masham Corridor zone which is situated in the northern part of the Dales, houses the town of Catterick and the Catterick Garrison.

Both of these areas have been identified where non-domestic sites can use hydrogen for heating purposes. Both the Garrison and Catterick town contain different types of non-domestic sites such as warehouses, industry, schools and regular shops. This area could see a total of 120GWh/year of hydrogen being used.

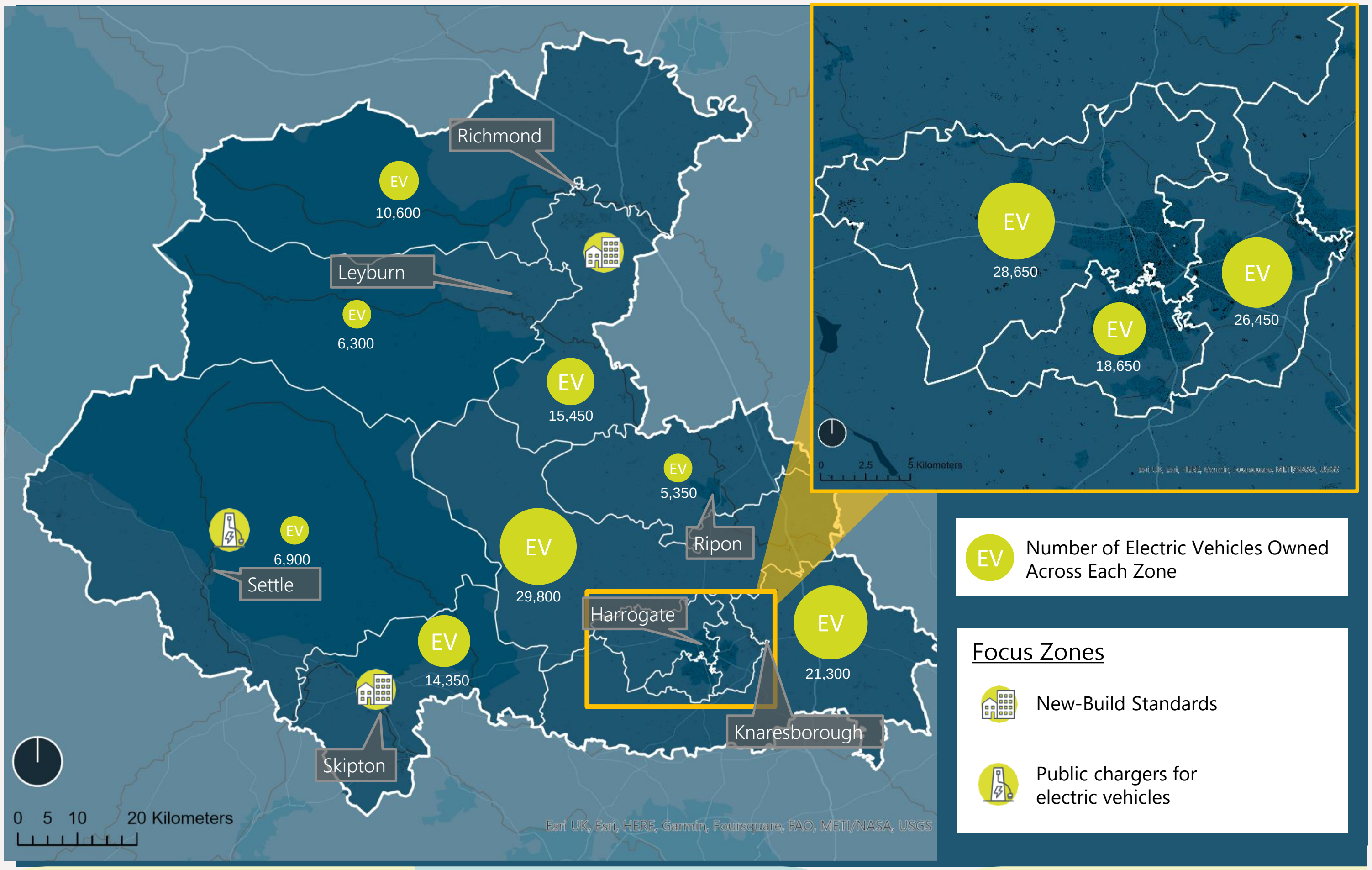
However, given the ownership of the Garrison by the Ministry of Defence, it will need to lead on the decarbonisation of the site.



Hydrogen uptake in the medium ambition scenario around Catterick

Transport

EV Overview



204,000
Electric cars (including plug-in hybrids) by 2040

312 GWh/year
Energy consumption for charging when 100% of cars and vans are electric

52%
Households have off-street parking, suitable for home charging

Electric vehicles (EVs) are expected to grow significantly in number as a proportion of total vehicle fleet, as purchase costs match or fall below those of petrol and diesel vehicles, local clean air zones favour clean vehicles, and national policy phases out petrol and diesel vehicle sales by 2030 and hybrids by 2035. Reaching net zero ahead of the national target would require strong incentives for residents to shift to electric vehicle purchases earlier, which could lead to the scrappage of working vehicles.

Projections of an increasing proportion of private electric vehicles are used to anticipate the electricity demand across the Dales for charging these vehicles, and the associated infrastructure upgrades that would be required. EV uptake is higher in the more suburban and rural areas of the Dales, with city dwellers being less likely to own cars.

Areas with large numbers of new builds expected can ensure homes are built with EV chargers in place, avoiding the need for costlier retrofit at a later date.

Options to reduce car usage should go hand-in-hand with electrifying necessary car journeys. Infrastructure which makes active travel safe and attractive brings health co-benefits, while public transport and car sharing business models and schemes (such as Harrogate Car Share) can reduce congestion.

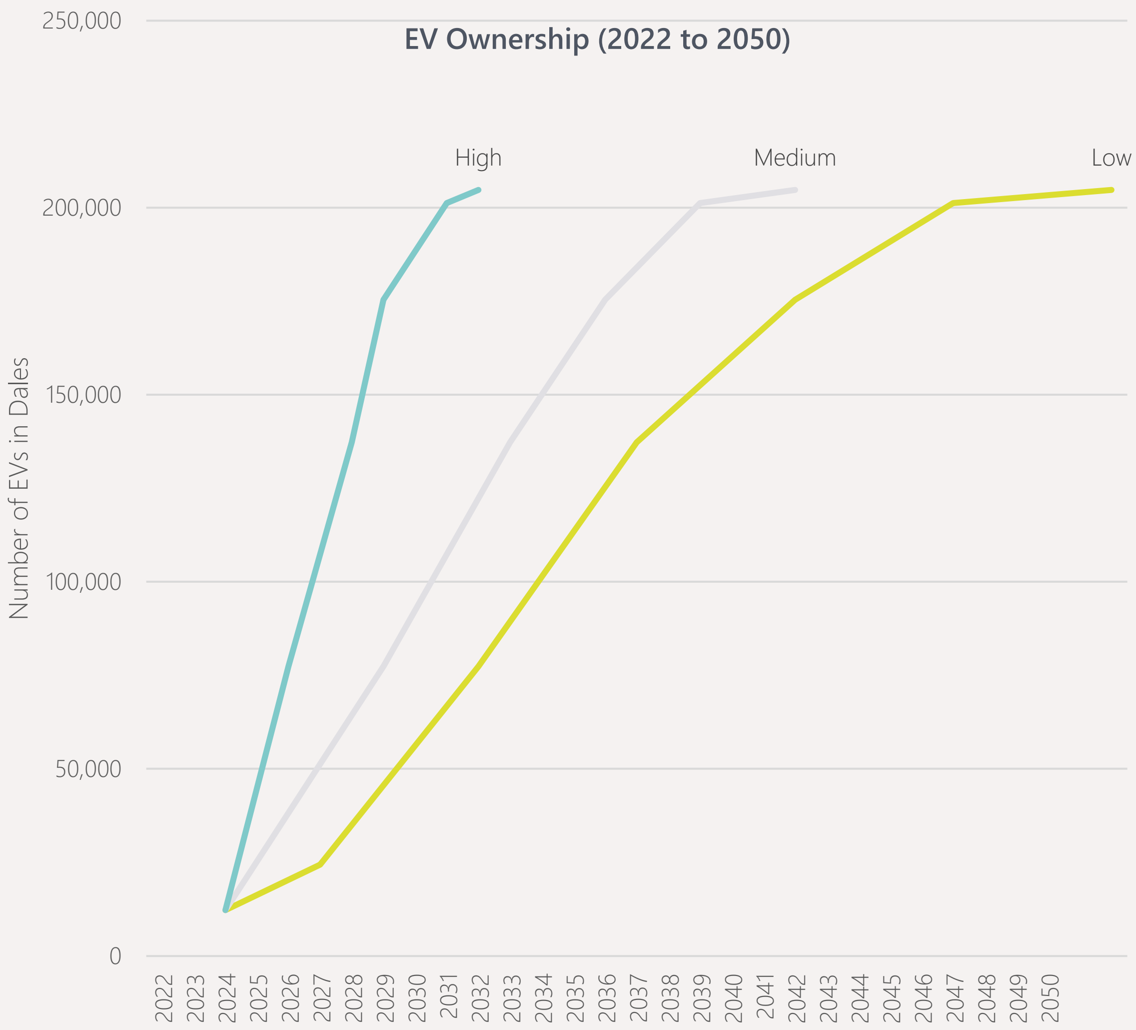
EV Projections

Based on projections by Transport for the North, plug-in cars and vans are expected to grow from their current level of around 12,800 in the year 2022 to over 90,000 vehicles (~50% of the total fleet) by 2030 and over 200,000 (100%) by 2050. To reach net zero before the national target, this transition would need to happen even faster, with the sale of new petrol and diesel vehicles having to end by 2025 if premature replacement of vehicles is to be minimised (assuming a 15 year vehicle lifespan).

Currently there are few options available to local authorities to give this level of control, however the introduction of low emission zones which charge non-EV owners for entering certain areas can help to drive behaviour. Access to abundant and reliable charging infrastructure will also be important to encourage the transition and keep up with demand. This provides confidence to residents that they can be part of the transition and removes the 'range anxiety' often cited as a block to EV uptake.

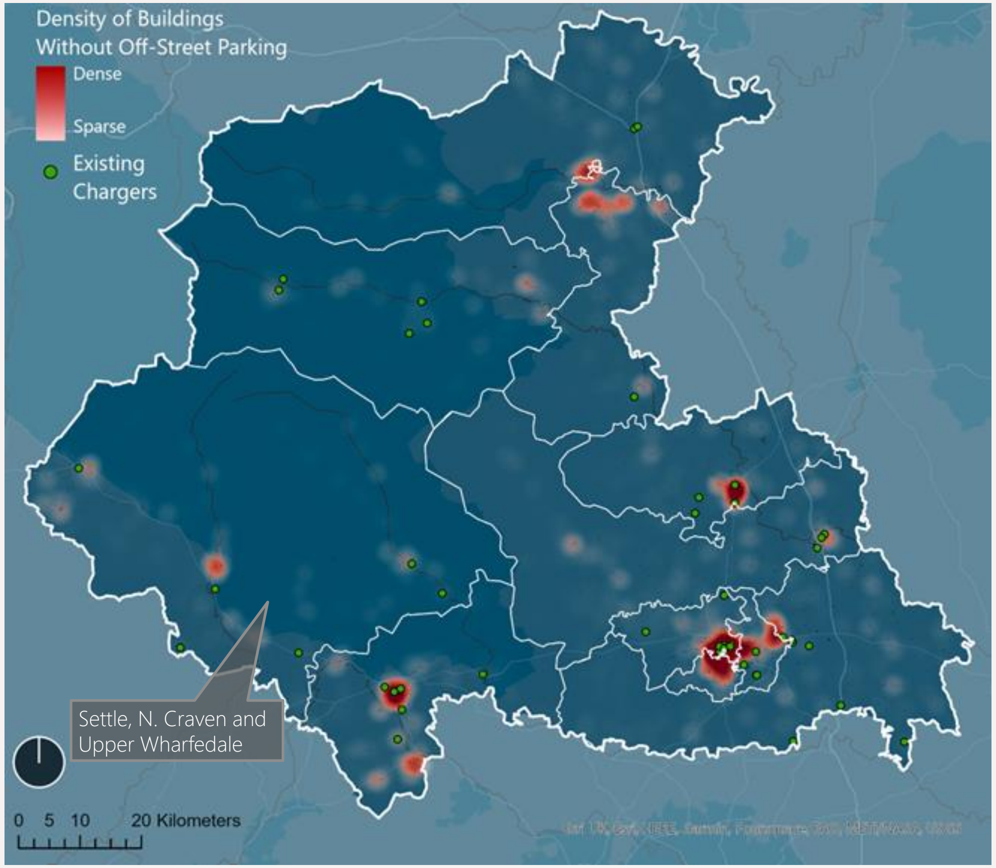
Given the seasonal nature of the tourist economy of the region, policy will need to address whether infrastructure should be provided for average or peak demand.

For more information about the Transport for the North data which fed into this plan please visit: https://evcivisualiser.z33.web.core.windows.net/



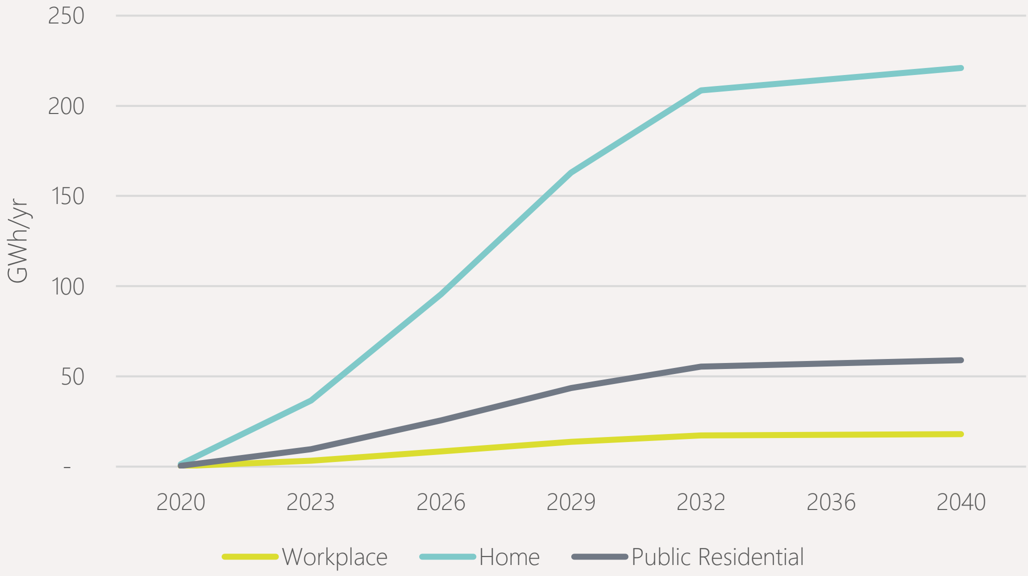
EV Charging Infrastructure

Density of housing without off-street parking & existing charge points



Areas of high density housing without off-street parking exist in a number of areas around the Dales, particularly urban areas. For example, around 43% of the Settle, N. Craven and Upper Wharfedale zone's residents have off-street parking, this zone would need to prioritised for public charging infrastructure to ensure an equitable transition to low carbon transport.

Growth in Energy Consumption for EV Charging by Location



Those residents without off-street parking will require ready access to charging hubs, kerb-side charging, destination charging, workplace charging, etc. Only 52% of dwellings have suitable off-street parking to facilitate home EV charging, therefore some areas will require significant investment in publicly accessible EV charging infrastructure. Funds such as the On-street Residential Chargepoint Scheme and the Local EV Infrastructure Fund can be utilised to support the development of this infrastructure.

The electricity requirement to charge electric vehicles in various locations is expected to grow as shown in the graph above. Home charging is likely to remain the most cost-effective and convenient way of charging an electric vehicle, therefore those who have access to off-street parking are assumed to choose this option whenever possible.

EV Focus Zones

The Nidderdale to Boroughbridge zone has the largest expected roll-out of EVs, due to high private vehicle ownership, with up to 30,000 expected to be in use by 2040. Given there is capacity on the electrical network, this has been identified as a focus zone for installation of public charging infrastructure.

Currently, public charging infrastructure is installed at Back Lane Car park (1 rapid charger), Yolk Farm & Minskip Farm Shop (1 fast charger) and Charltons of Boroughbridge car dealer (1 slow charger), and a shortfall is likely in the near future.

Across the Nidderdale to Boroughbridge zone there is 52.7 MW currently available on the network. The total charging requirement of would be approximately 14.32MW, coming from a mix of public and private infrastructure, suggesting sufficient network capacity to absorb this increase in demand. Given that there are a large number of flats in the area and little off-street parking, it is likely that most of this will need to be made up through public charging infrastructure. This will require a mixture of kerb-side and destination/site charging.

In areas where demand is likely to be high, North Yorkshire Council should work with private providers to increase provision of charge points whilst targeting public sector funding towards providing charging infrastructure in areas where the private sector could struggle to build a business case. This could be due to lower charge point utilisation and where problems with network constraints or high connection costs could be additional barriers.

Density of homes without off-street parking in Boroughbridge in red, with flats highlighted in yellow and existing charge points in green

EV Focus Zones

In addition to the residential charging requirements, the Nidderdale to Boroughbridge zone contains a number of Bed & Breakfasts, hotels and guests houses. Given that the demand in these is seasonal, we would expect a larger requirement at certain points in the year. It is unlikely that all visitors would have access to EV infrastructure from their hotel and thus provisions need to be made to meet seasonal demand.

Policy decisions will need to be made to decide if assets need to be designed for peak or average use.

There are a number of car parks such as the Boroughbridge River Parking which could have charging infrastructure installed and Back Lane Car park where existing charging could be expanded.

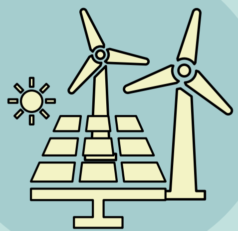
Boroughbridge High School in proximity to the Sports Centre and Leisure Centre presents a clear opportunity for the expansion of public charging provision, where residents and visitors will routinely spend prolonged periods parked. Beyond that the large supermarket, industrial estate, offices and schools in this area could host public EV charge points.

Density of homes without off-street parking in Boroughbridge in red, non-domestic buildings and existing charge points highlighted

Local Generation

Overview

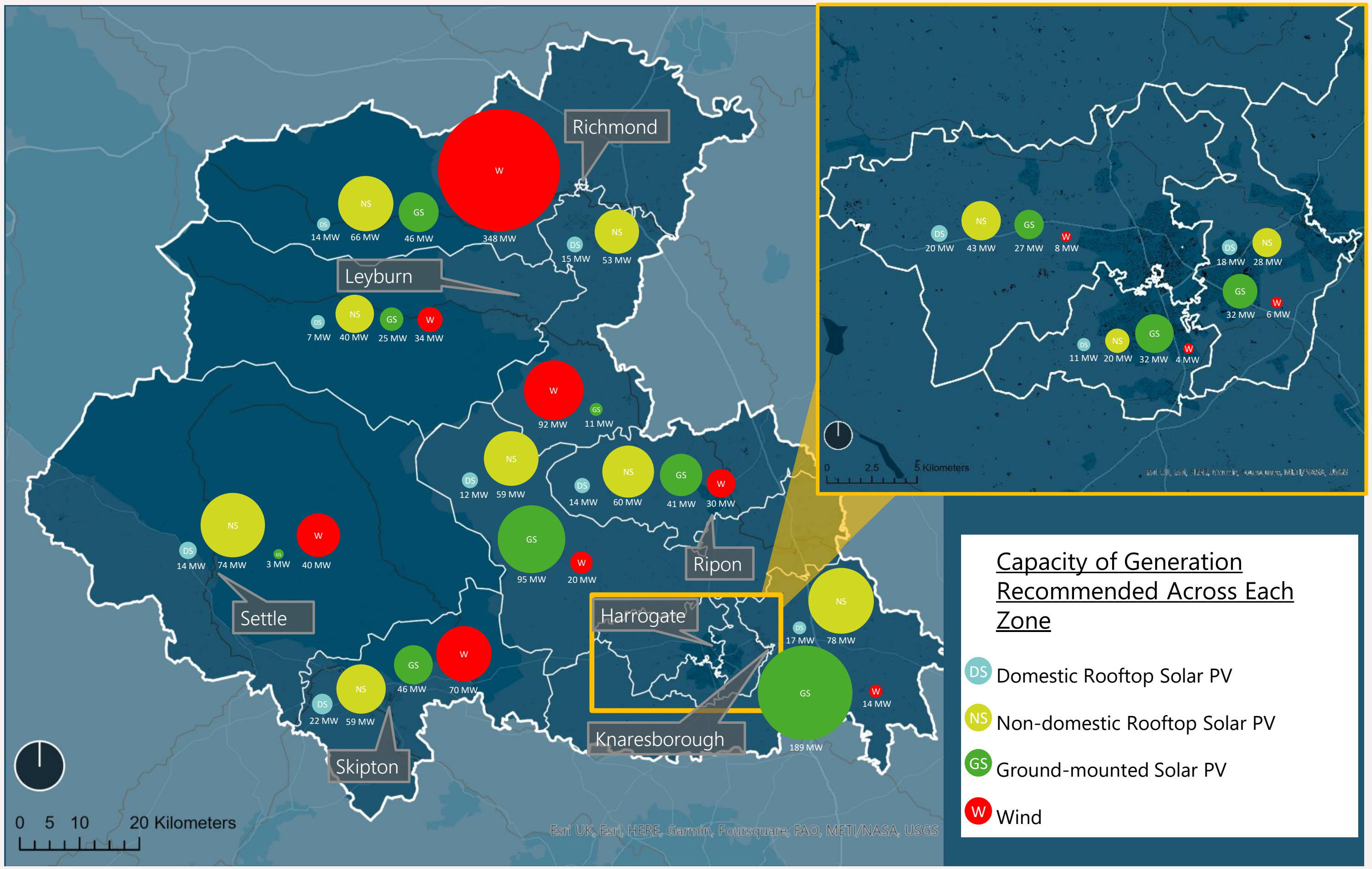
1,950MW



of wind and solar generation capacity could be developed

£1.8b

Investment in local renewable generation



Electrification of heat and transport is essential for decarbonisation, since oil and gas supplies are unlikely to decarbonise, or face major uncertainties doing so. This electrification will increase the Dales' annual demand for electricity from 1,900 GWh to 2,777 GWh between 2020 and 2040. The Dales can participate in producing that electricity from low carbon sources by deploying rooftop and ground-mounted solar as well as onshore wind, which will reduce the area's emissions faster than relying on grid decarbonisation.

Local generation of electricity is less essential for reaching net zero than eliminating local fossil fuel use in buildings and vehicles. This is because the electricity network is on a credible path to full decarbonisation, with an intention to reach net zero by 2035. Renewable generation built in the Dales can contribute to national progress as well as accelerating local emissions reductions. The area which is suitable for large scale renewable projects could produce more energy than is used locally, even allowing the Dales to become a net exporter if fully developed, though network capacity upgrades would be needed to realise the full potential.

To further reduce the spend on imported electricity from the grid, the Dales may wish to explore the use of power purchase agreements (PPAs)* and novel approaches such as local market places and peer-to-peer (P2P) networks. These all aim to maximise the consumption of local production within the area.

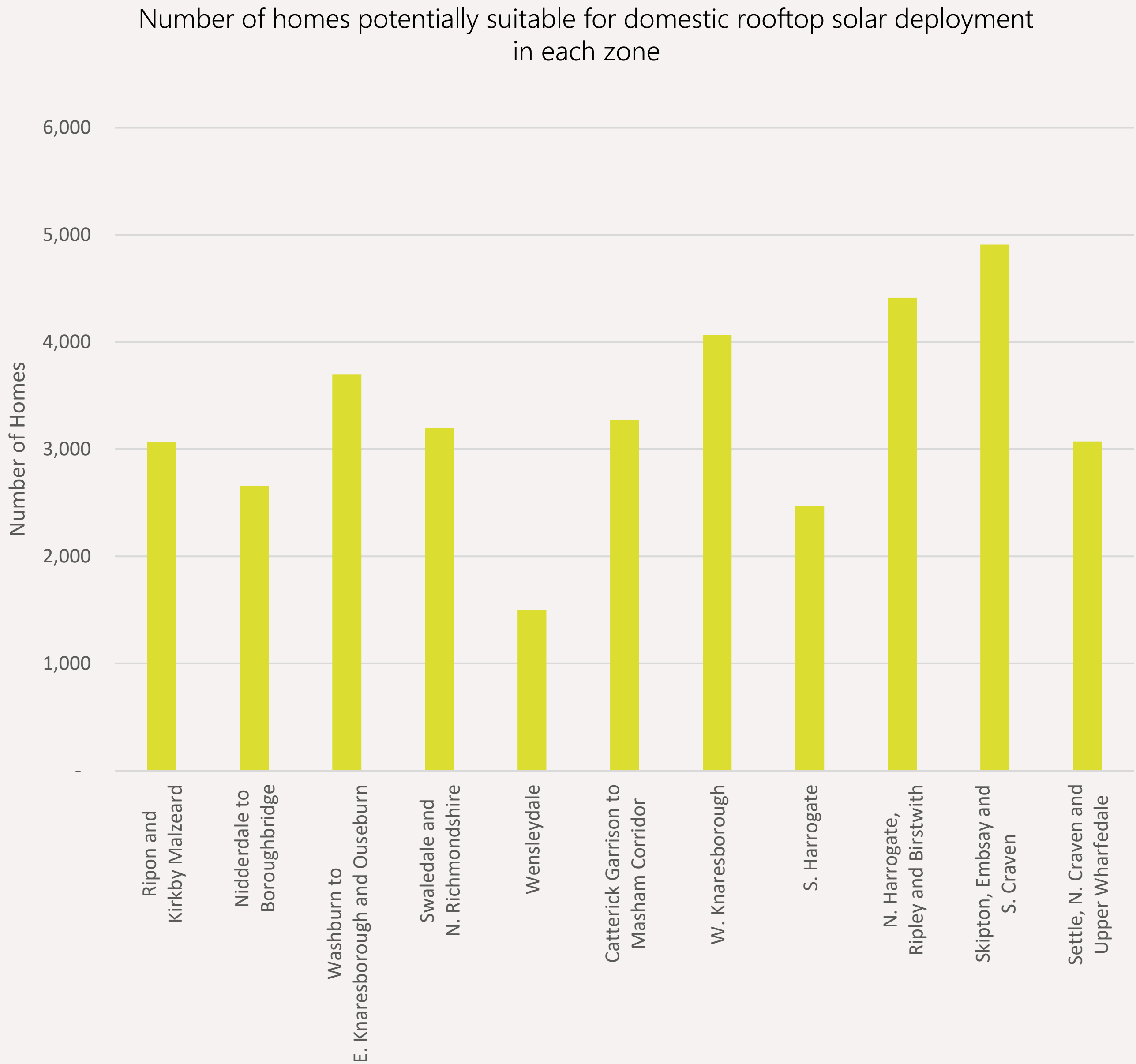
* For an example of a virtual PPA with large solar developments, see https://www.novartis.com/news/media-releases/novartis-set-achieve-100-renewable-electricity-its-european-operations

Domestic Solar PV

Although more expensive per unit of energy generated than ground mounted solar and wind, domestic PV makes use of roof space that would otherwise be unused and can provide direct financial benefits to householders. The recent energy crisis has resulted in rising costs of wholesale energy, which further improves the investment case for rooftop solar while energy prices remain high. A large rollout of domestic PV is of value, regardless of the net zero target date chosen and therefore is deemed to be low regret.

Based on roof orientation and pitch, homes are identified for solar PV suitability. If fully developed, a capacity of 163 MW could be installed at a total capital cost of £180 million. This would contribute 157 GWh per year to the Dales' 2,777 GWh electricity demand in 2040 (with electrified heating and transport).

Local authority owned housing and social housing could be prioritised for roll-out of domestic PV in the Dales. This approach could stimulate supply chain and skills in the area, preparing them for a larger roll out in private rental and owner-occupied residences. To assist owner-occupiers to invest in solar installations, programmes such as group buying schemes, which can be initiated by the LA, can be utilised to develop economies of scale and reduce costs to residents.



Domestic Solar Focus Zone

The Catterick Garrison to Masham Corridor zone has the highest level of fuel poverty within the Dales. Generating electricity on-site can reduce the requirement to purchase electricity from suppliers which can reduce costs to the household (depending on how the PV installation is paid for). The roll-out of a scheme like this could start with social housing by working with key stakeholders with the potential for whole neighbourhood approaches to raise the profile of domestic solar to householders and drive down costs with scale and efficiency of installation.

A roll-out of over 14MW of solar PV could be undertaken in the Catterick Garrison to Masham Corridor zone.

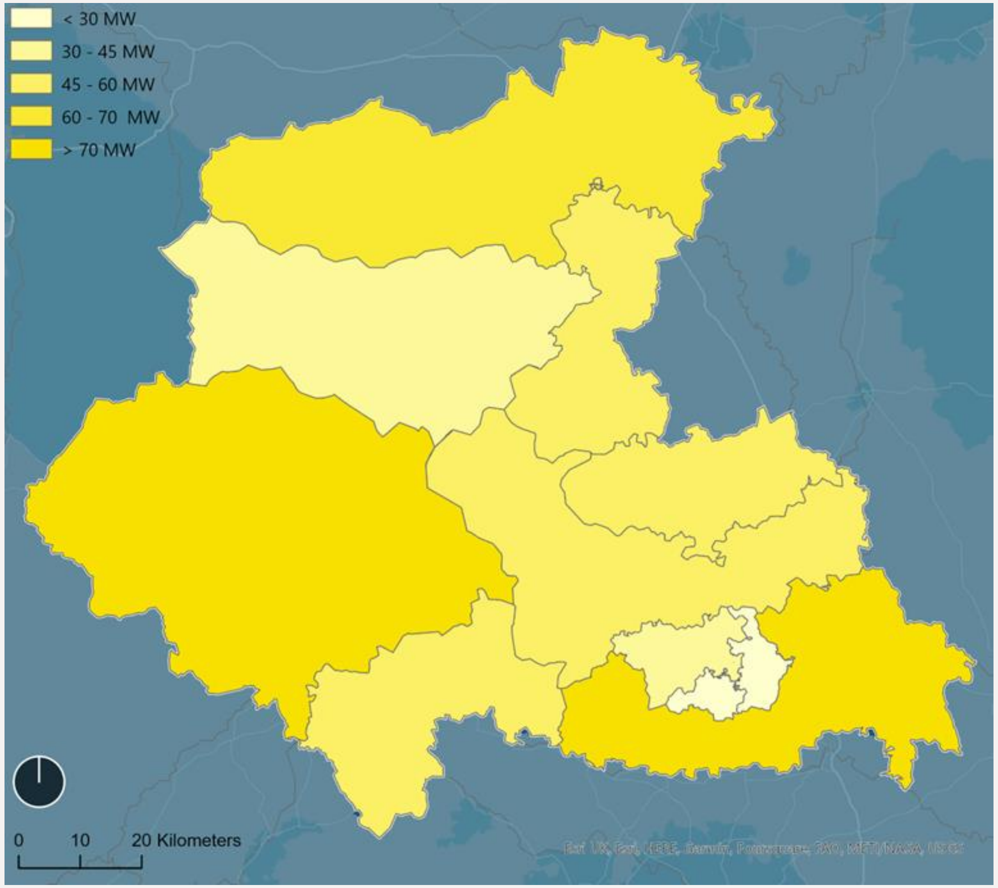
Homes identified for rooftop solar in the Catterick Garrison area

Non-Domestic Solar

Non-domestic solar installations also contribute to cost effective decarbonisation plans for the Dales, regardless of the level of ambition. They have the potential to be more cost effective than domestic solar, but there are some challenges that arise when the building owner is not the bill payer. These projects would be low regret and should give confidence that it is an appropriate investment. The map shows a potential capacity for non-domestic solar deployment, based on available roof space and assumptions about the extent to which it could be developed.

Non-domestic building construction is more variable than domestic, and it is not possible to say if a building is suitable for PV without a site survey of the roof construction, load bearing capacity and the extent to which other building services such as cooling vents are present.

Within the Dales, non-domestic sites require approximately 1,740GWh/year of electricity. With nearly 13MW of rooftop solar already deployed on non-domestic sites, there is potential for a total capacity of 580 MW to be installed. This would deliver nearly 560 GWh/year, leaving around 1,196 GWh/year of non-domestic demand to come from other sources.



Total potential for rooftop solar PV on non-domestic buildings in each zone

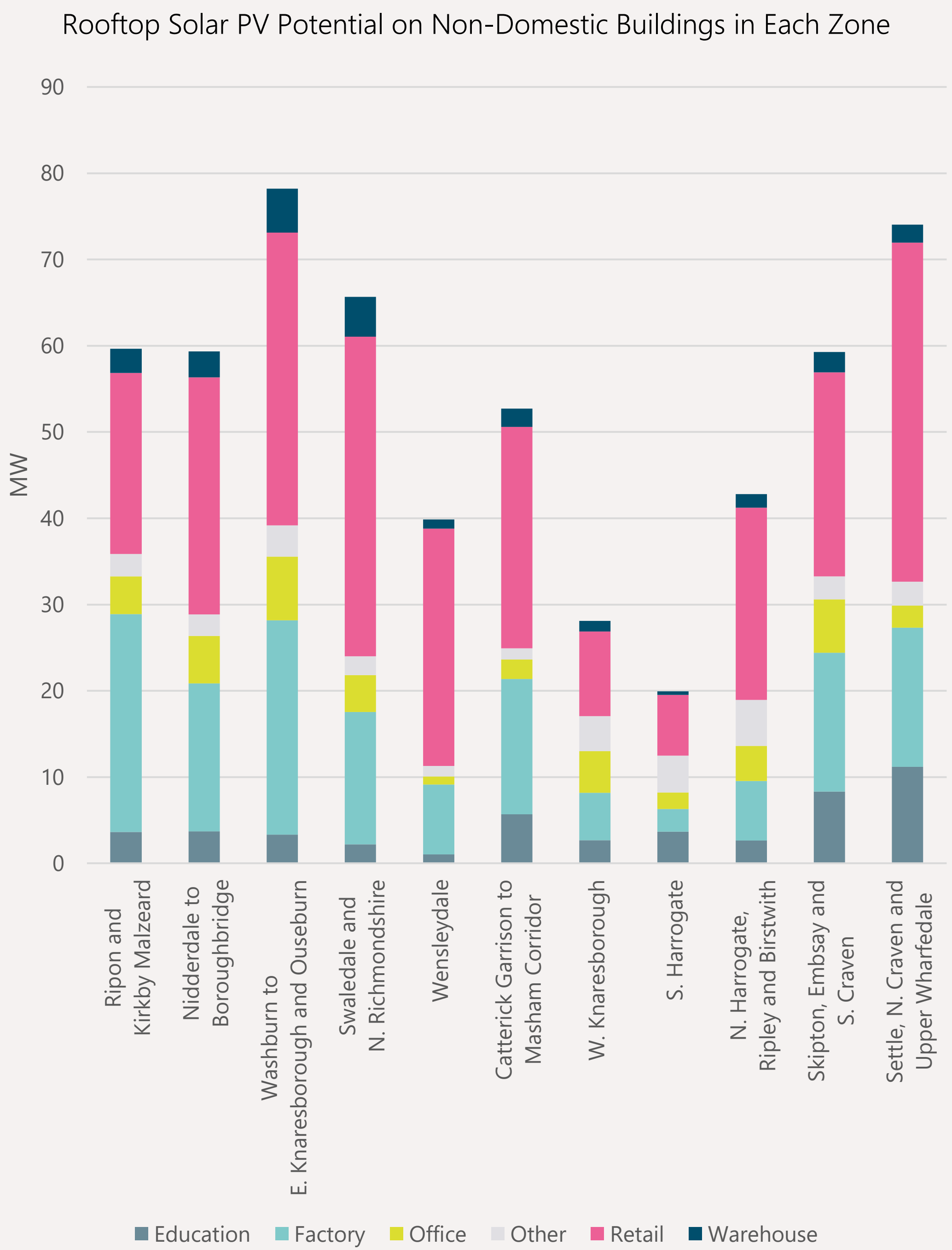
Non-Domestic Solar PV

The Dales has a strong tourism industry so there are many hotels, bed & breakfasts and guest houses. In the chart, these businesses are categorised as retail. The owners of accommodation sites have significant potential to benefit from self generation, especially as demand is likely to coincide with generation in the summer months. Each building would need to carry out site studies to assess the true capacity of their site as well as the business case.

Schools, factories and offices could also benefit from maximising self-consumption, since operating hours are likely to coincide with generation. Additionally, schools are already being supported to deploy rooftop solar around the country and could be a targeted as low-regret projects.

For sites with high electricity requirements, private wires to generating sites, if available in the vicinity, could be utilised to guarantee low carbon energy, keeping the value of low carbon generation within the Dales. Power purchase arrangements could be another way to keep that value within the Dales, whilst utilising the electricity network.

Local flexibility markets could be created to maximise local use of generating assets. This is particularly true of Richmond, Harrogate and their surrounding areas. These areas contain a high density of non-domestic buildings, proximity to large scale generation and local authority assets. Additionally, Richmond is an area identified to be fuel poor where unlocking the value of local low carbon generation in the area could help to alleviate this issue.



Large-Scale Renewables

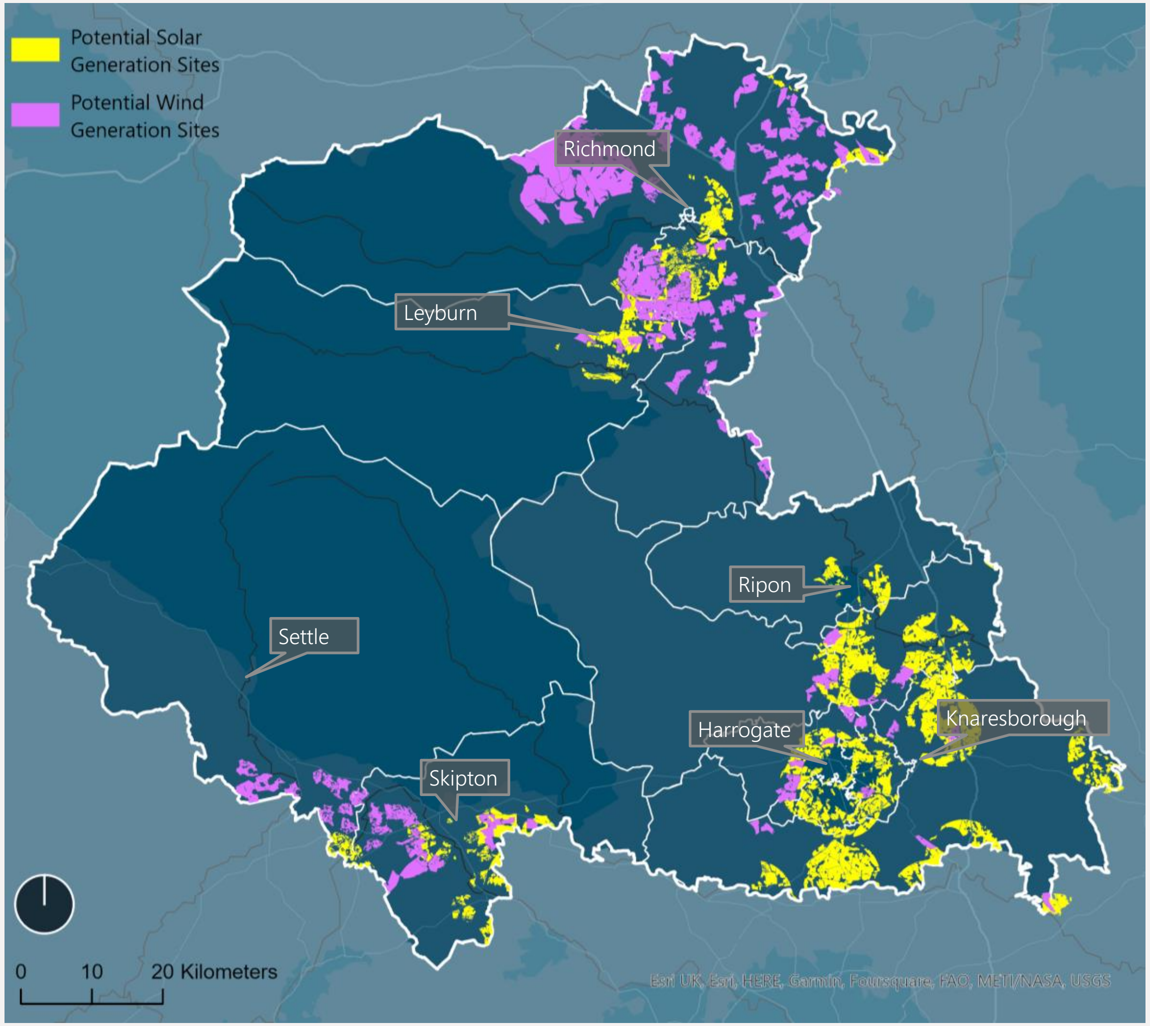
Large-scale renewable generation, particularly ground-mounted solar PV and onshore wind, due to economies of scale, are the most cost-effective way to produce low-carbon electricity. Arrangements such as power purchase agreements (PPAs) and community ownership co-ops can capture this value locally. Many examples of community ownership models can be found in the UK, with local residents enjoying income or bill savings from the schemes.

The requirements for land purchase, planning permission, public acceptance and connection to the grid can put limits on their scale and deployment. While obstacles to development could delay the journey to net zero, they will not necessarily make it impossible to reach, since grid electricity is also [expected to reach net zero by 2035].

Land in the Dales has been assessed for its suitability for ground-mounted solar and on-shore wind. Around 17,000 hectares is suitable to build ground-mounted solar, which is enough space to host 10.2GW of solar capacity. A further 16,650 hectares is suitable for on-shore wind assets, sufficient to build 666MW of capacity at a cost of £792m*. While wind farms require far more land per megawatt, most of the area remains unused as space between turbine bases, which can continue to be used for other purposes such as agriculture.

The remaining annual energy demand after developing rooftop solar and wind to their full potential could be met by developing only 5% (~547MW) of the ground mounted solar potential. This would come at a cost of £291m*.

Although providing significant benefits to the energy generation profile, the development of wind turbines can face opposition based on aesthetic impact to areas of beauty such as the Dales. If the remaining demand after roof solar PV was fully deployed were to be served by ground-mounted solar PV, a capacity of 2139 MW (21% of full potential in the Dales) of ground-mounted solar PV would need to be installed costing £1,925m.



Land suitability for large scale renewable developments

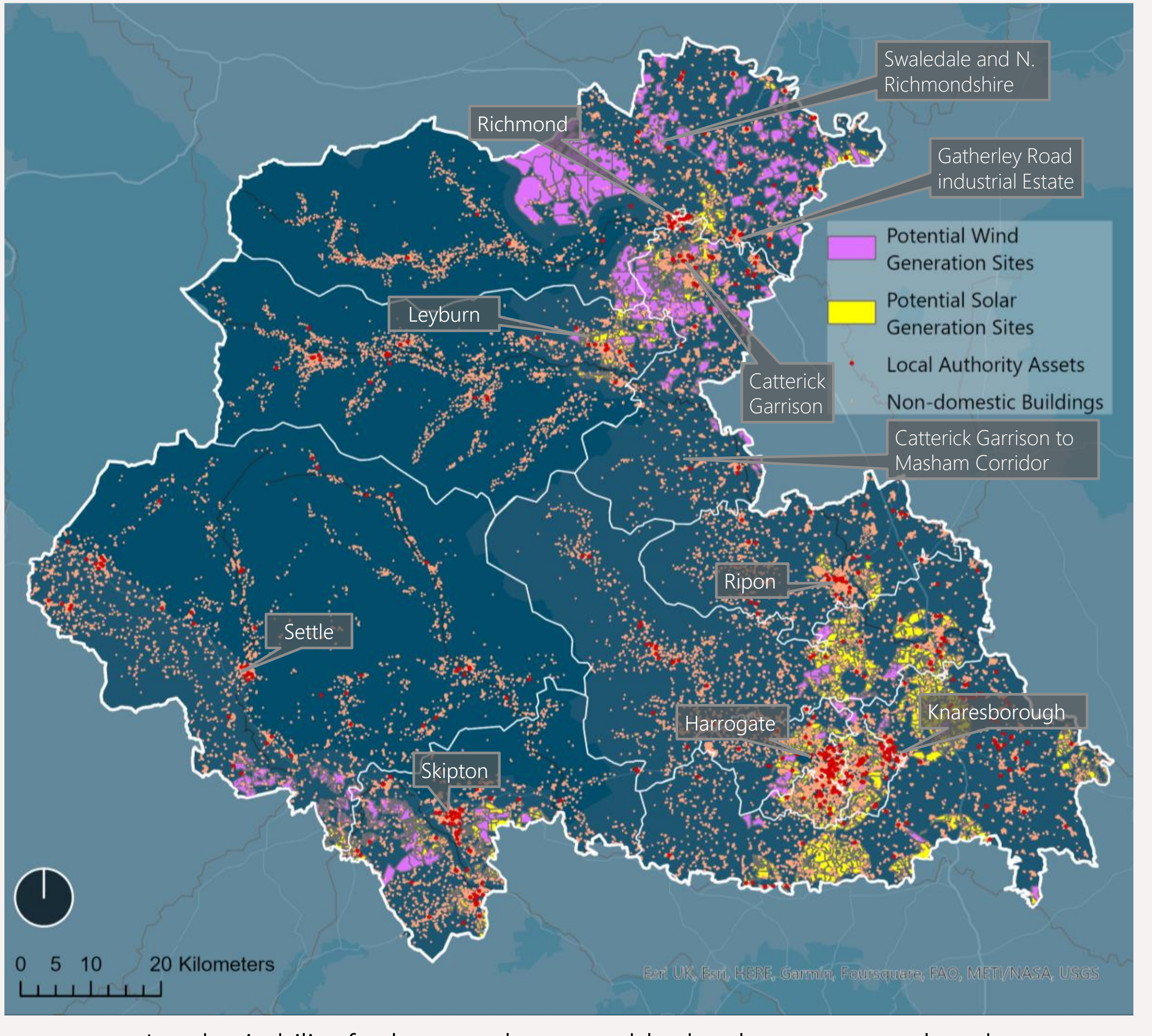
* Costs based on BEIS figures, including pre-construction cost and infrastructure cost scaled to capacity
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/911818/GC20_Key_Data_and_Assumptions.xlsx

Large-Scale Renewables

It is not expected that ground-mounted solar would be built upon a single piece of land, but over a large number of distributed plots across Dales. These could become part of a local energy marketplace if permitted by regulation, where generation assets could be matched with off-takers requiring electricity, allowing local businesses to directly benefit from the production of locally generated low carbon electricity. Sites are selected according to criteria including vicinity of roads, quality of agricultural land, areas of outstanding beauty and other factors. Sites which would accommodate less than 10 MW or more than 50MW of solar capacity are excluded. For wind, less than 2MW and more than 10MW is excluded, to identify projects of suitable scale for investment and deployment.

The map highlights where non-domestic buildings and council-owned assets are located alongside land which has been deemed suitable for ground-mounted solar and wind.

As an additional benefit, well designed and located ground mounted solar and wind farms can support the Dales' commitment to biodiversity and protecting local wildlife. Many site specific measures can be taken to improve biodiversity, e.g. restoring peatlands on on-shore wind sites.

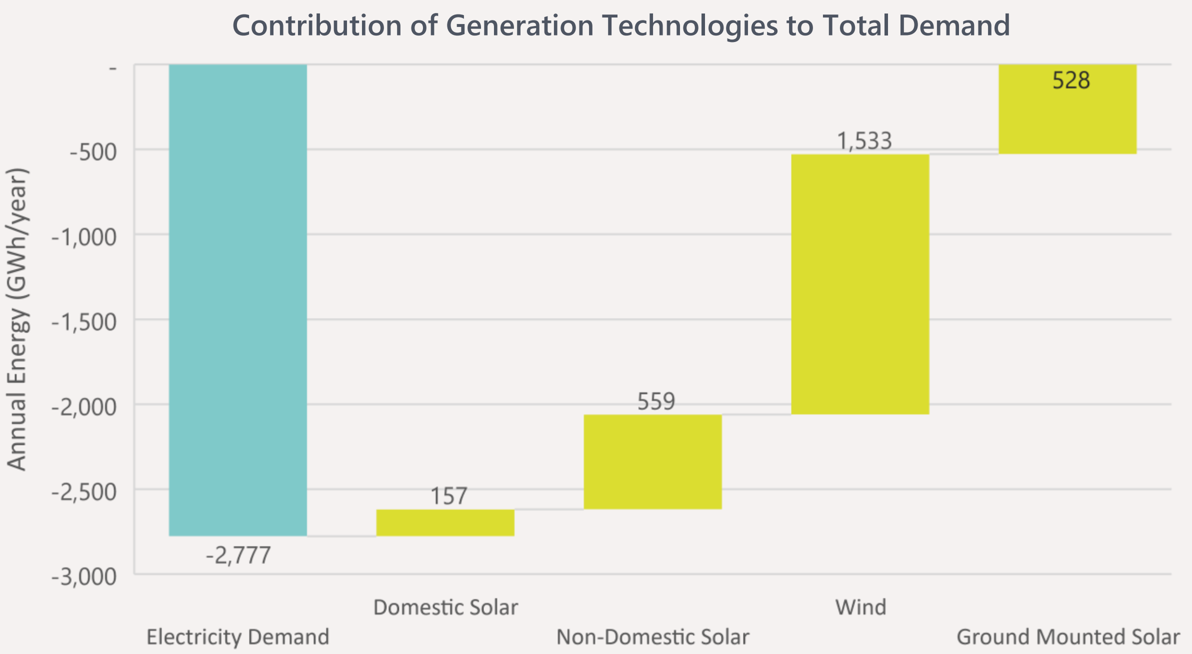


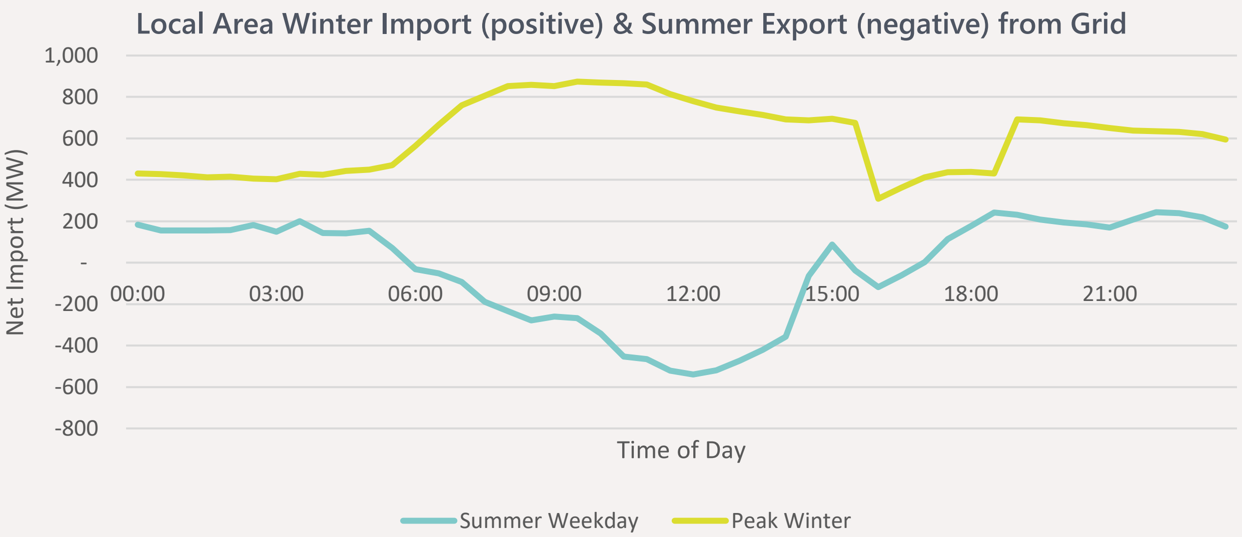
Land suitability for large scale renewable developments overlayed with potential purchases of energy

Around Skipton there are sites suitable for ground-mounted solar and wind. With its industrial estates and local authority buildings, there is potential here for private wires, PPA contracts and P2P markets to be developed to off-take and optimise regional use of generation. Catterick Garrison and Gatherley Road Industrial Estate and its surrounding areas between the Swaledale and N. Richmondshire zone and the Catterick Garrison to Masham Corridor zone could also benefit from the proximity of local generation, non domestic buildings and local authority assets.

Batteries and other types of energy storage could be co-located with ground mounted solar and wind. Co-located battery storage can help to smooth generation and enable participation in grid balancing services, increasing revenue streams available.

Meeting Energy Demand Locally





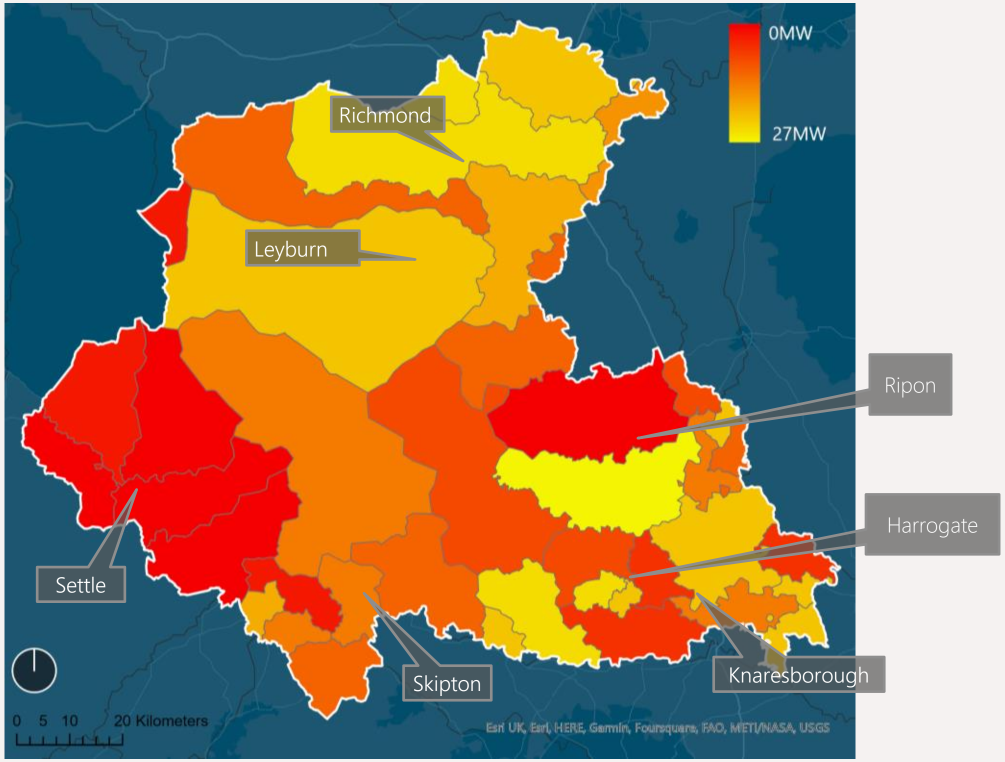
Priority has been given to fully developing domestic and non-domestic rooftop solar, as no land is needed, and residents and owners can make direct use of the generation. Wind has also been prioritised for maximum development given that it matches winter heating demand, and the land around wind turbines remains useable for other purposes. The development of ground mounted solar is then scaled to cover the remaining local requirement for energy, on a net annual basis. The contribution of each type of generation is visualised against the total local demand in the top graph.

Since renewable generation will vary with weather, time of day and season, the Dales would still need to import from the electricity grid when supply from local generation does not meet demand. Wind and solar are somewhat complementary, with wind increasing in winter months and occurring through the night, while still days are often very bright. Battery storage would enable more of the generated electricity to be utilised locally at times of demand but would not be suitable to store the energy inter-seasonally to use the summer surplus in winter. Local hydrogen production may offer a viable option for seasonal storage. Without seasonal storage, the summer peak export, as can be seen from the lower graph, will be almost 550MW. There is limited local capacity for increased generation in the area (see https://www.northernpowergrid.com/generation-availability-map). Any large scale deployments of solar generation will need to be coordinated with Northern Powergrid to ensure that network capacity is available.

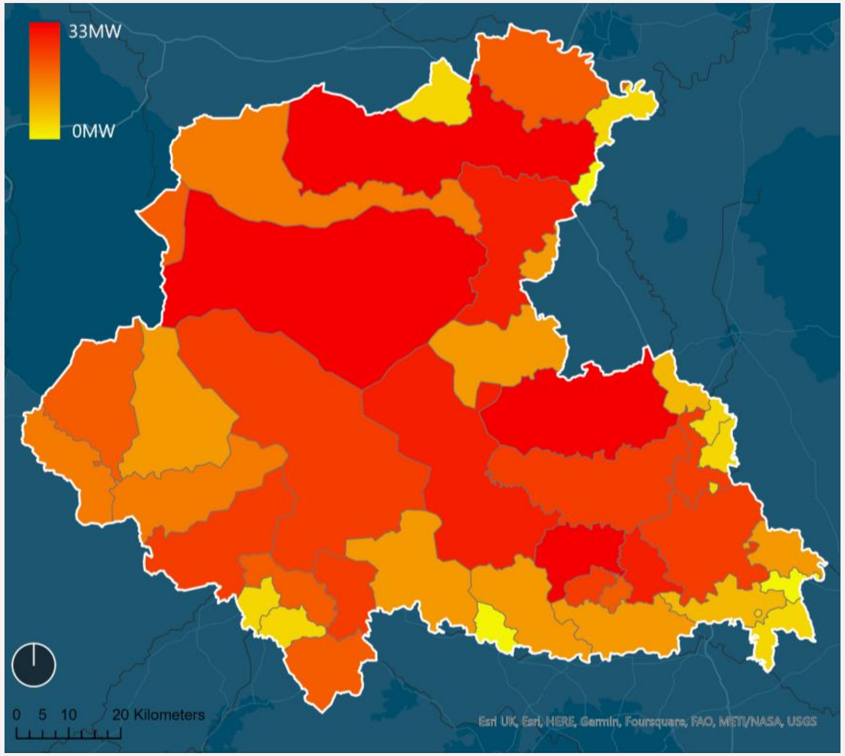
National Grid's Future Energy Scenarios envisage around 20 gigawatts (GW) of solar and 7GW onshore wind in the North of England by 2050. If distributed evenly by household, this would be about 440MW of solar and 154 MW of wind for the Dales. There is limited local capacity for increased generation in the area (see https://www.northernpowergrid.com/generation-availability-map). Any large scale deployments of solar generation will need to be coordinated with Northern Powergrid to ensure network capacity is available. However, National Grid plan for very large flows of wind power from Scotland towards Southern England. Producing more of this energy south of the border could be beneficial for net energy flows and fit with transmission capacity between the north and south.

Networks, Storage & Flexibility

Upgrading the High Voltage Network



Current headroom on the high-voltage network



Increase in peak demand on the high-voltage network to 2040

A total gross investment of £62m in capacity upgrades is estimated across the high and low voltage networks by 2040 to accommodate the changes in this pathway. Ofgem's Open Letter on the Green Recovery Scheme "is aimed at accelerating low regrets, shovel ready network investment under the remainder of the RIIO-ED1 period [ends 31 March 2023] to stimulate economic recovery and support faster delivery of decarbonisation benefits for customers, while supporting Government's climate change ambitions."

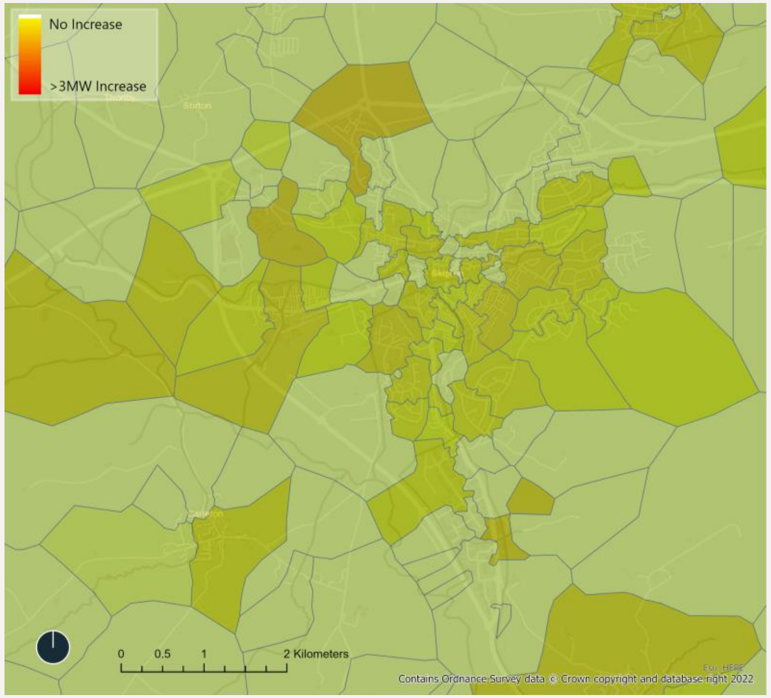
The high voltage network consists of substations on land owned by the distribution network operator, supplying feeders which run to secondary substations, which in turn serve multiple streets. The maps above show the areas of Dales served by each HV substation.

The amount of headroom currently available on the high-voltage network varies significantly across the area, as shown in the left map. Areas in the west which are situated in the Dales currently have little headroom available, while areas around the Yorkshire Dales National Park have headroom available.

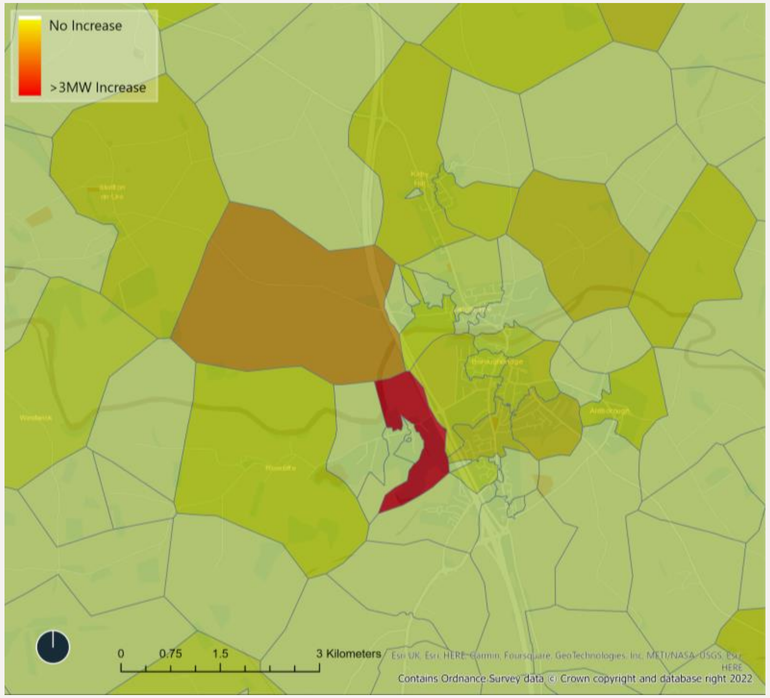
Given the level of electrification of heat and transport, it is expected that there will be an increase in demand by 2040, as we can see from the map on the right. The west of the Dales area where we currently see limited headroom, we also expect to see a mild increase in demand in the HV network. Such areas could benefit from working with DNOs to look at flexibility, which would aggregate to have a reduced impact on the HV system and thus reduce costs by reducing or deferring upgrade requirements.

For other areas such as around Ripon and Harrogate where there is currently limited headroom but show a large increase in demand in 2040, there will be a requirement to upgrade the network.

Upgrading the Low Voltage Network



Demand increase at LV level in Skipton 2040



Demand increase at LV level in Boroughbridge 2040

The low voltage network consists of smaller neighbourhood substations, supplying feeders which run under pavements or roads to each building or on overhead wires in rural areas. The maps above show some example areas that parts of the LV network see significantly more peak demand increase than others. In the town of Skipton there is a reasonably even increase from current levels across the area. On the map to the right, we see increased demand at the LV level in Boroughbridge by 2040. This area includes factories and other large non-domestic sites which start on gas. Most of the non-domestic buildings move to electricity for heating, thus causing a large increase in demand.

This significant increase in demand is an opportunity to take advantage of flexibility. DNOs could tender for flexibility services on the market and look to delay upgrades. However, further work would be needed to identify solutions, aligning with the DNOs' business planning processes. Use of 'smart' technologies, such as smart charging for EVs, residential storage could delay the need for network upgrades as demand is moved away from peak times. Aggregators can work at the low voltage level to participate in local flexibility to combine smaller resources to a point at which they can actively provide network solutions.

In some areas flexibility will not be sufficient to manage increased demands without network reinforcement. Discussing plans well in advance with the DNO will ensure that both provision of flexibility and network reinforcement can be planned so that projects are not delayed longer than absolutely necessary through lack of network capacity.

Outline Priority Projects

Overview

In creating the LAEP, near-term projects have been identified where the proposed North Yorkshire Council and York & North Yorkshire LEP could start the process of implementation. These near-term projects are either:

- Low regrets – common under various scenarios but may require further enabling action before they can be progressed.
- Quick wins – which can be carried out in the near-term without major blockers.
- Focus zones - specific areas within the LAEP boundary that have a cluster of near- term components.

The purpose of identifying specific outline priority projects is to provide stakeholders with projects that can immediately be implemented to make progress towards net zero. The following section specifies details of these near-term projects, including details such as locations and financial information. Energy Systems Catapult's "Net Zero Go" platform* provides resources to help local authorities design and develop energy projects.

Further details, information and advice for implementing the Outline Priority Projects can be found towards the end of this document, in the sections titled 'Next Steps' and 'Business Model Innovation'.

* https://www.netzerogo.org.uk/s/

Building Insulation

Areas of fuel poverty can benefit from their homes being retrofitted with improved building fabric. The Skipton, Embsay and S. Craven zone has areas, such as Greatwood, which could benefit from such measures with fuel poverty experienced at >20% of dwellings in the area.

Location	Greatwood within the Skipton, Embsay and S. Craven zone		
Building Type	Terrace 1965-1979	Terrace 1945-1964	Terrace Pre-1914
Number of homes	54	145	14
Insulation Type	Basic	Basic	Deep
Cost	£30 000	£225 000	£165 000

Building fabric upgrades levels in the Greatwood area in the southern part of Skipton Surveys required to confirm suitability of upgrades for individual homes.

Heating Demonstrators & Enablers

Heat Pump Demonstrators

The Skipton, Embsay and S. Craven zone sees a significant number of terrace houses (just over 7,200) receiving air source heat pumps, meaning this could be a good area for early demonstration neighbourhoods to develop the approach for terrace installations, identifying common barriers for this housing type and finding solutions, such as recommending changes to planning rules. Along with the priority insulation projects outlined in Greatwood, this could pioneer an approach for building fabric upgrades of terrace houses combining insulation and heat pumps. This combination reduces the need for radiator upgrades whilst also reducing the capacity of heat pumps required.

Location	Skipton, Embsay and S. Craven
Building Type	Terrace
Number of homes	7,200
Heating System	Air Source Heat Pump
Cost	c. £50m

A street of terrace homes in the Skipton, Embsay and S. Craven zone

Flats in the W. Knaresborough zone

District Heat Network Demonstrators

The W. Knaresborough zone and the Skipton, Embsay and S. Craven zone have a significant numbers of flats that could connect to a district heat network (650 combined). Early steps could be to gauge resident appetite for participation in heat networks and spread awareness of the technology and its role in the future energy system. Substantial numbers of semi-detached and terrace homes could also connect to the heat network in these zones.

---

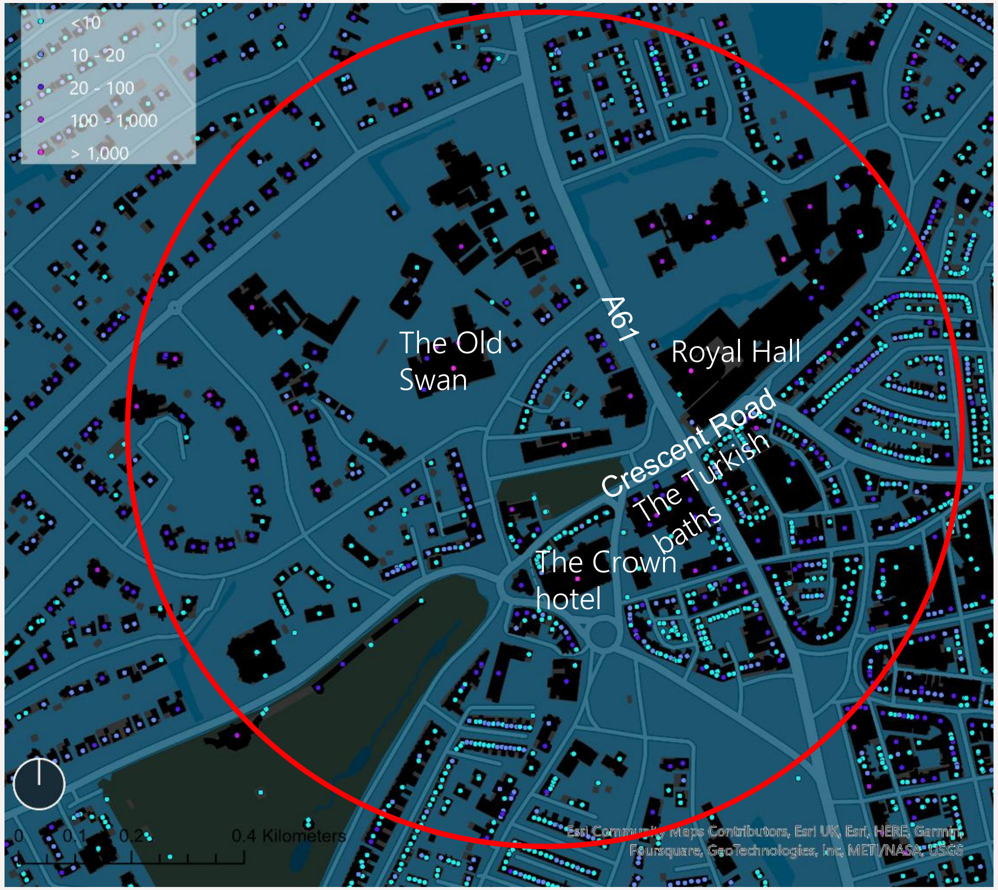
* https://es.catapult.org.uk/case-study/electrification-of-heat-2000s-flat-heat-pump-installation/

District Heat Network – Harrogate Centre

Harrogate Centre – Area 1

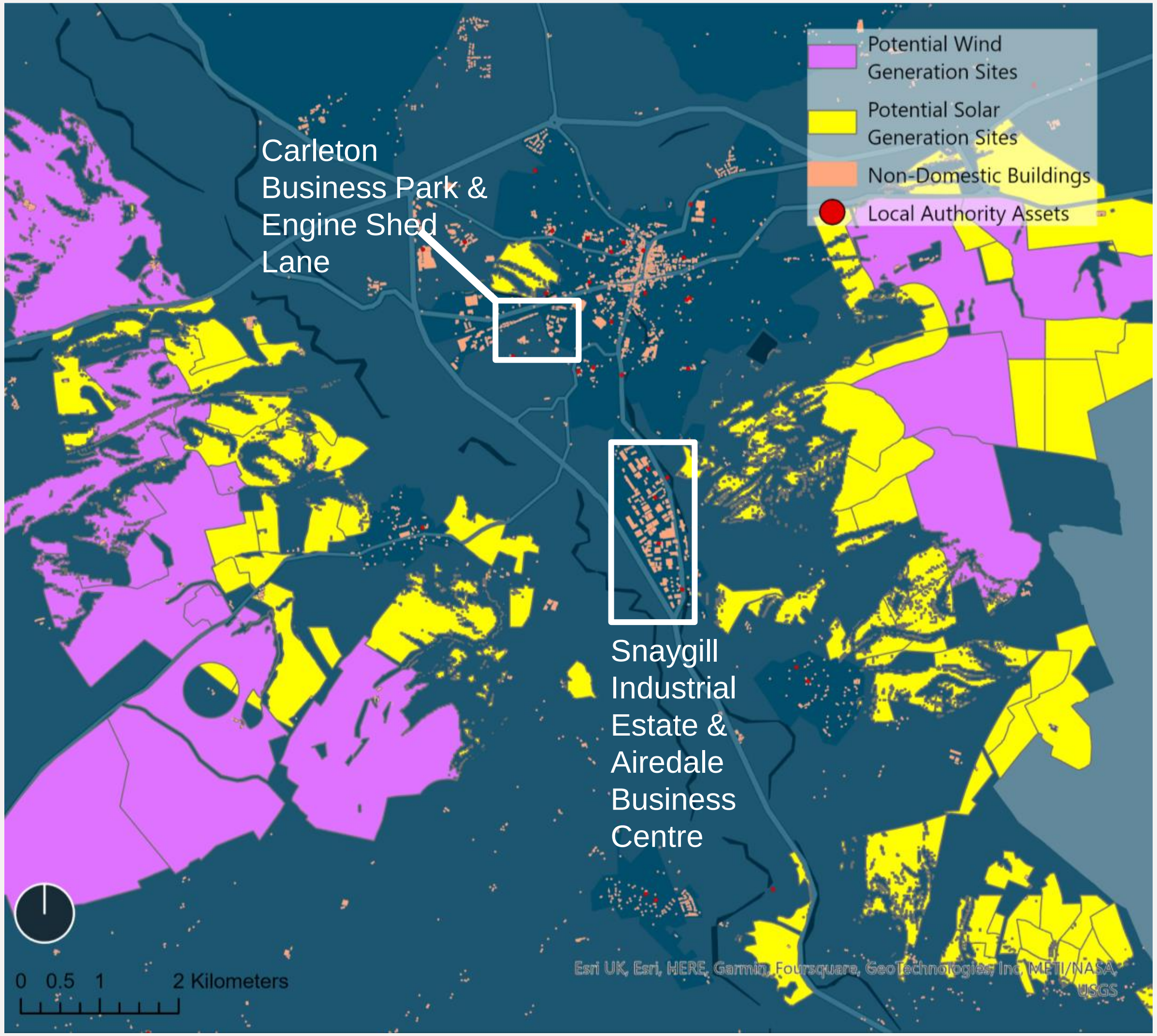
Fleshing out Area 1 of the Harrogate heat network starting points outlined in the Heating section, this area around the Turkish baths includes a number of hotels, holiday and short-let accommodation, cinema and exhibition centres, as well bars, nightclubs and restaurants. Dual use buildings which are commercial and residential contribute to nearly 30% of the non-domestic demand in the area. Flats account for nearly 75% of domestic demand. Given how many non-residential buildings in the area are large users, a number of them could be used as anchor loads depending on the final structure of the network. These anchor loads could be combined with blocks of flats to further improve the business model.

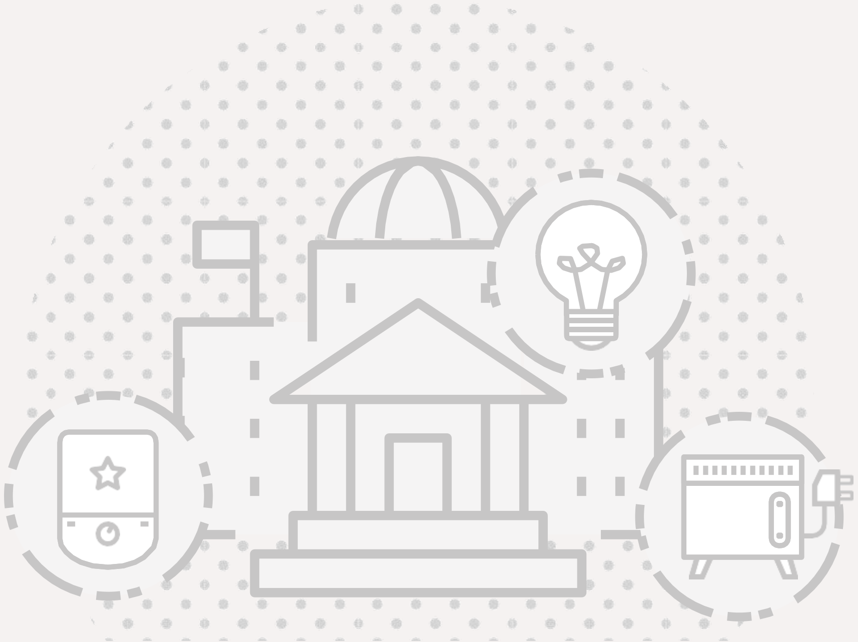
Location	Harrogate
Connected Domestic Dwellings	1,222
Connected Non-Domestic Properties	870
Total Peak Demand	19.1 MW
Total cost	c. £37m



Heat demand for buildings in Area 1 of Harrogate heat network starting points (MWh/year)

Large Scale Renewables



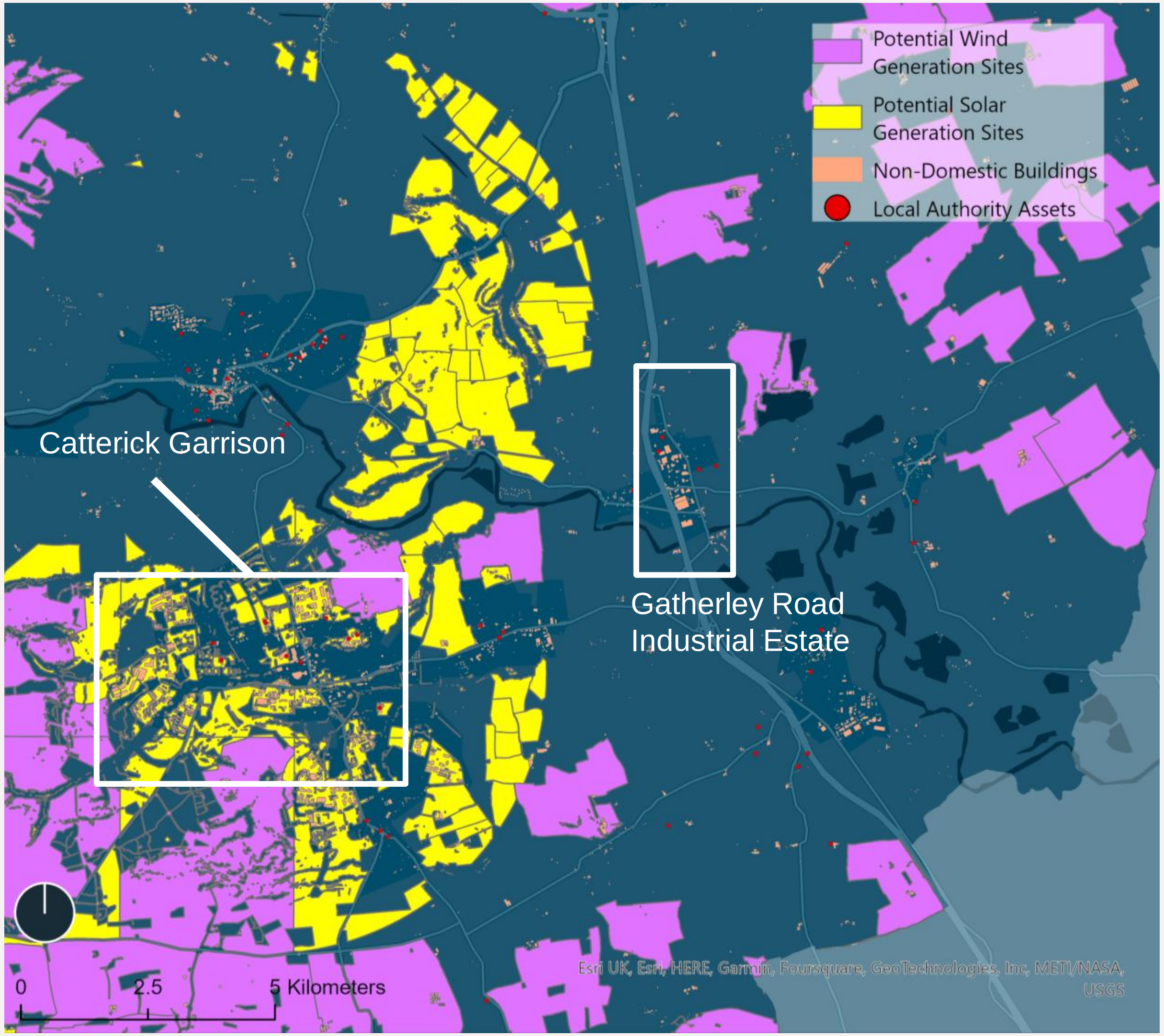


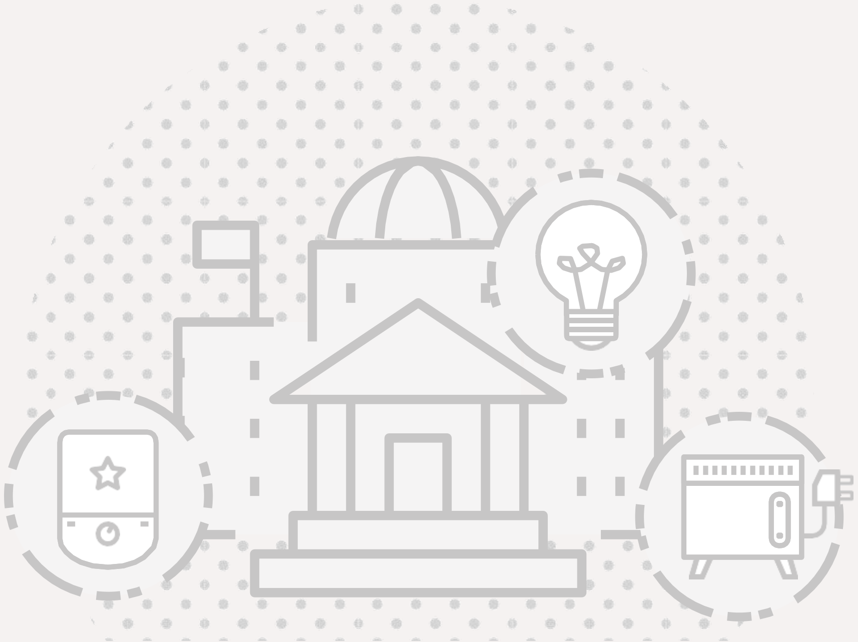
In the market town of Skipton, we see there are extensive parcels of land which have been as suitable for ground mounted solar and wind turbines. The total potential shown amounts to 273MW of solar PV and 48MW of wind.

To the south of Skipton there is Snaygill Industrial Estate with Airedale Business Centre close by and a sewage treatment plant. To the west, there is Carleton Business Park alongside Engine Shed Lane and Sandylands Sports Centre. Given the proximity of the ground mounted solar and wind sites to the industrial, commercial and public sites, there could be a private wire installed to allow these sites to be a direct off-taker of the generated electricity. Opportunities for individual or aggregated PPAs could also be explored.

Surrounding Skipton, other sites such as Cross Hills and opportunities around Gargrave could also benefit from such a development.

Large Scale Renewables



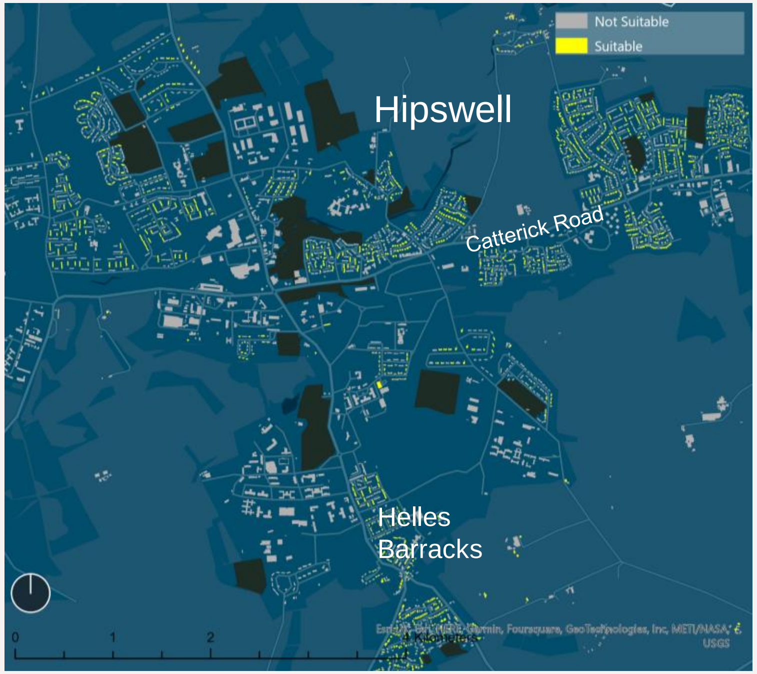


On the boundary between the Swaledale and N. Richmondshire zone and the Catterick Garrison to Masham Corridor zone, we see there are extensive parcels of land which have been identified to be suitable for ground mounted solar and wind turbines. The total potential shown amounts to 450MW of solar PV and 75MW of wind.

On the Swaledale and N. Richmondshire zone side of this boundary, there is Gatherley Road Industrial Estate close by. Given the proximity of the ground mounted solar and wind sites to the industrial site, there could be a private wire installed to allow these sites to be a direct off-taker of the generated electricity. Opportunities for individual or aggregated PPAs could also be explored.

Catterick Garrison contains many large buildings with consistent demands associated with the garrison itself such as barracks, offices and leisure centre, as well as schools and a hospital. Similarly, the proximity to renewable generation presents an opportunity to realise the benefits of low carbon electricity locally.

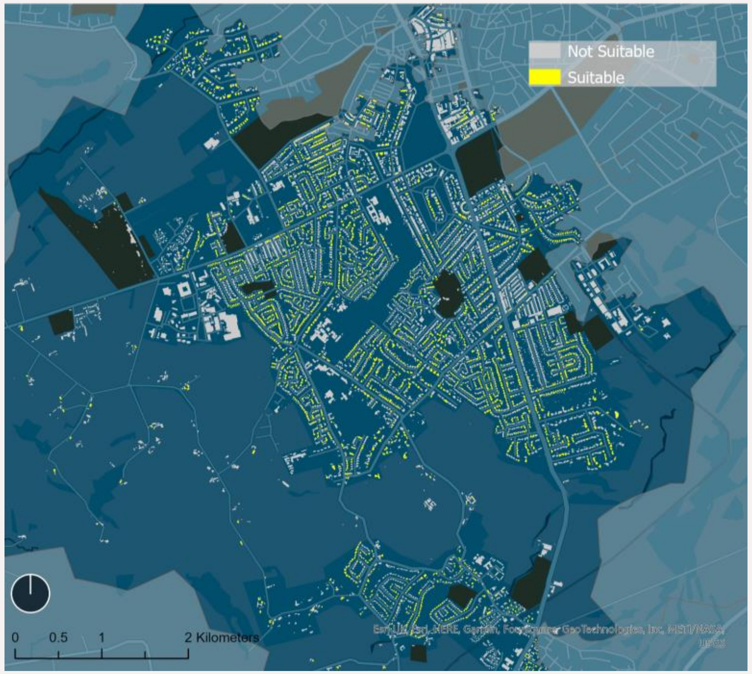
Domestic Solar PV



Homes with potential suitability for rooftop solar PV around Hipswell

Zone	Catterick Garrison to Masham Corridor
Location	Hipswell
Number of homes	c. 1,800
Total Cost	~£9m

Specific homes to be targeted for such projects e.g. social housing, which the local authority has control over, further feasibility studies should be undertaken to fully understand options and potential benefits to individual households.



Homes with potential suitability for rooftop solar PV around Hull Road Park

Zone	S. Harrogate
Location	In the town of Harrogate
Number of homes	c. 2,400
Total Cost	~£12m

The able-to-pay market is the largest market in any area. With the increase in cost of energy, rooftop solar can provide a mechanism to reduce costs of energy for households. Local Authorities can support uptake in able to pay areas through Solar Together programmes, allowing residents to pay lower fees for procuring and installation of rooftop solar services.