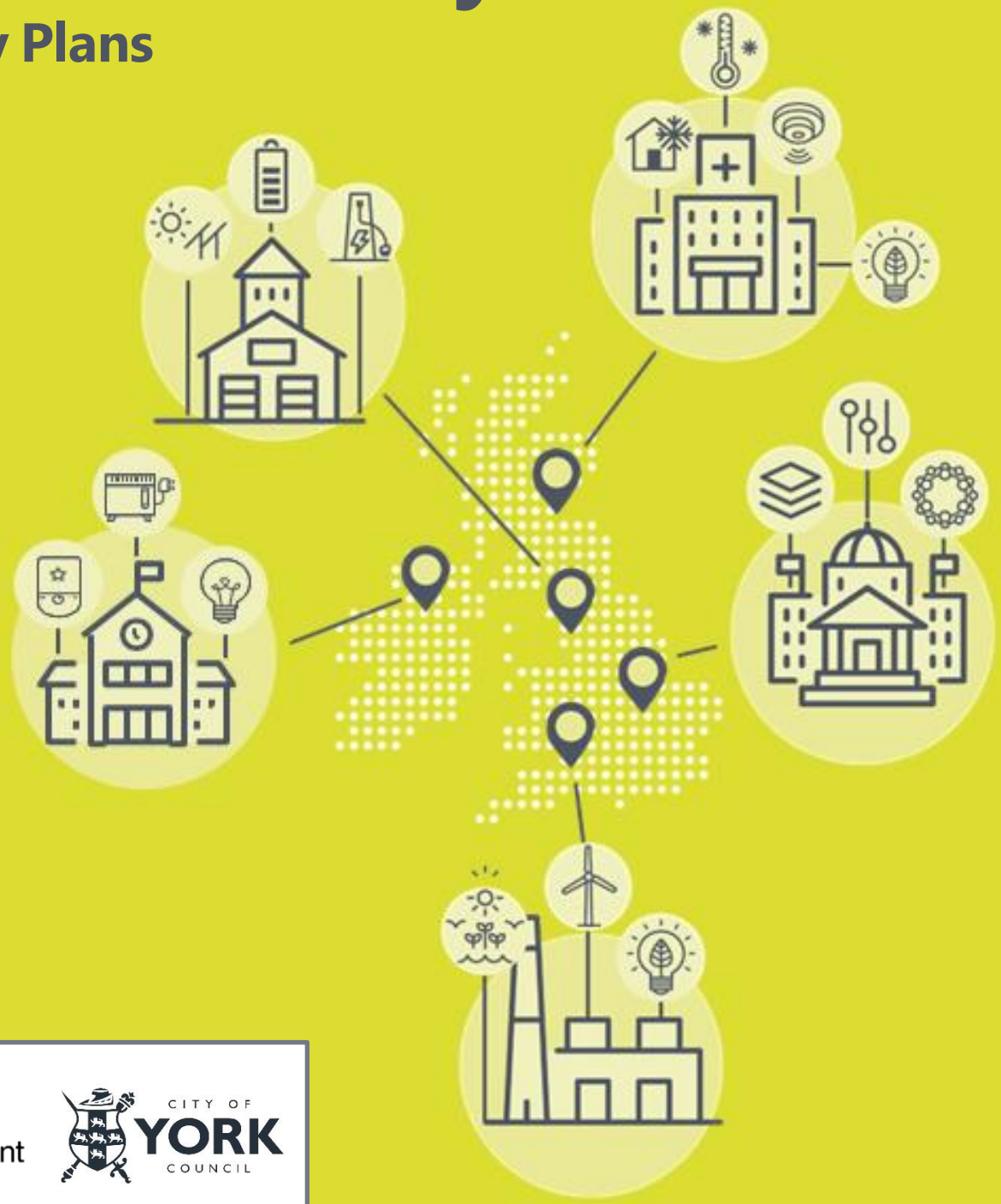
North Yorkshire & City of York

Local Area Energy Plans

CATAPULT Energy Systems



York & North Yorkshire LOCAL ENTERPRISE PARTNERSHIP

HM Government

CITY OF YORK COUNCIL

LOCAL AREA ENERGY PLAN

Acknowledgements

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Contributors

The development of the LAEPs has been supported with contributions to the Steering Group by the local authorities, national park authorities, and gas and electricity network operators in the region (see logos). The Steering Group have been instrumental in shaping the LAEPs, supporting data gathering, examining model assumptions and providing local economic and political context, and proofing the draft documents.

Further support was provided by a Technical Advisory panel, made up of local and regional energy experts, and a Peer Challenge Group, made up of people with expertise in adjacent disciplines such as fuel poverty, social inclusion, skills and economic development and biodiversity.

Energy Systems

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Executive Summary

Context & Current State

*In 2019, the UK government amended the Climate Change Act (2008), that previously legislated for a reduction in greenhouse gas emissions of 80% by 2050 compared to 1990 levels, to be net zero. The change is significant - no longer can anything be considered 'too difficult' to tackle – every source of emissions must be accounted for and addressed.**

Reaching net zero will be a monumental task requiring significant, far-reaching action across the entire country at every level. The national government will be required to set policy and provide targeted funding to support the transition, and individual householders and businesses will need to make decisions about their heating systems, modes of transport, and behaviours. However, local areas will arguably be the keystone in this transition. Local and regional authorities and other stakeholders will be required to plan their area's transition to net zero accounting for the infrastructure and economic challenges and opportunities that are borne of it.

To meet this need and further the decarbonisation of local areas, Energy Systems Catapult (ESC) pioneered the local area energy planning (LAEP) approach to deliver a comprehensive, data-driven and cost-effective plan for decarbonisation of the energy system. Importantly, the approach requires working closely with stakeholders to build upon progress being made and incorporate existing plans.

* https://es.catapult.org.uk/guide/guidance-on-creating-a-local-area-energy-plan/

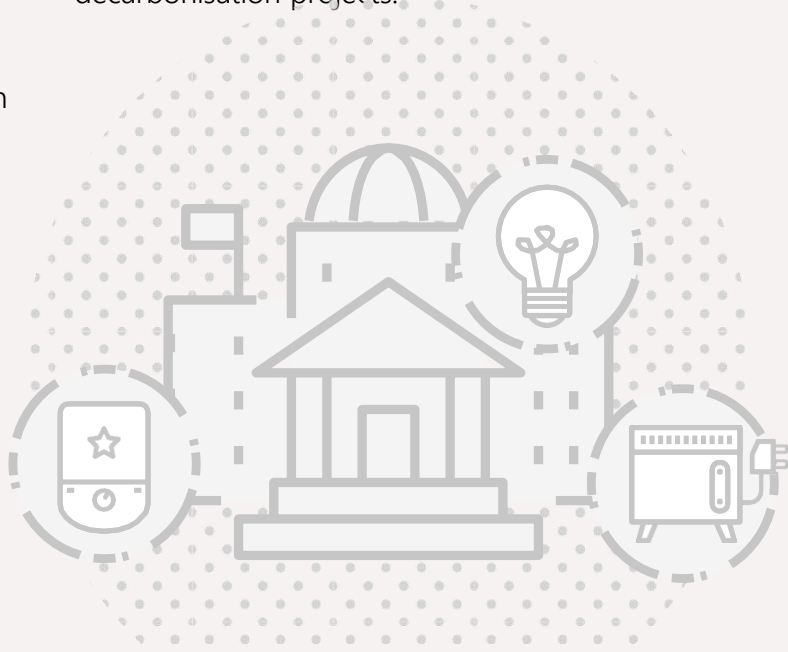
To ensure a strategic and coordinated approach to decarbonisation across the region, Y&NY LEP have led the development of York & North Yorkshire's Routemap to Carbon Negative, which is underpinned by the Carbon Abatement Pathways study. When completed, these gave Y&NY, and their local stakeholders, an understanding of the high-level measures that were required, the policies that needed to be established and adopted by which they could reach net zero by 2034, and carbon negative to 2040. Some of the detail included in these are the number of dwellings that require energy efficiency upgrades, the heating systems that need to be replaced and an indicative amount of renewable energy generation required.

When combined with the local area energy plans (LAEPs) in this report, Y&NY should have a good understanding of 'why' action needs to take place, 'what' needs to be done, and 'when' and 'where' this needs to happen. By including stakeholders in the process of developing these plans and future work on the feasibility of projects, the 'who' and 'how' will become clearer over time.

Decarbonisation of the energy system requires transformation and targeted investment. However, much of the investment to reach net zero is envisaged to come from households when they replace their current systems e.g. switching from a fossil gas boiler to a heat pump, or traditional internal combustion engine vehicle to an electric vehicle (EV). Beyond this, private finance and local/central government will be important to realise the overall goal.

Although local goals and targets for decarbonisation have been adopted by local governments, following a consultation on local government reorganisation, it was proposed that the current county, district and borough councils would be replaced by a new single unitary council for North Yorkshire alongside the City of York unitary council in April 2023. Existing North Yorkshire local authorities have already been working together to make progress towards decarbonisation, and the merger into a single authority cannot stall this progress.

Devolution is also being sought for York & North Yorkshire, creating a new combined authority to cover the two unitary council areas. This will bring more opportunities for local decision making, including on major investments and priority decarbonisation projects.



Scenarios & Pathways

Scenarios

To carry out the modelling and analysis required to produce a LAEP, the York and North Yorkshire region was split into 44 geographical areas or 'zones' based on their connection to the electricity network (these do not follow any typical political or geographical boundaries).

Following discussions with key stakeholders, zoning was agreed, and three future scenarios were identified for consideration:

- A high ambition scenario with a 2030 net zero target for the energy system.
- A medium ambition scenario with a 2040 net zero target for the energy system.
- A low ambition scenario with a 2050 net zero target for the energy system, in line with the UK as a whole.

All of the scenarios were created to be complimentary to the Carbon Abatement Pathways from previous work. Aiming for a net zero energy system by 2050 (a 'low' ambition scenario) would result in the 2034 net zero target being missed regardless of the speed of decarbonisation in other areas not considered by the LAEP.

Further to this, a "do nothing" scenario was modelled where no decarbonisation actions take place, providing a counterfactual for cost and carbon impacts of the scenarios to be calculated.

This plan centres on the medium ambition scenario, aiming to reach a net zero energy system by 2040, but draws comparisons to the other scenarios throughout. Eliminating carbon emissions in a local area requires the replacement of heating systems in most private dwellings and businesses, and for every petrol and diesel vehicle to be taken off the road, supported by large investments in infrastructure and the development of large land areas for renewable generation. The investment, skilled trades, supply chain capacity and co-ordination across a wide range of actors required to reach this goal even by 2040 will require a step change across society from today's status quo. The ambition aligns with the Routemap to Carbon Negative and, once the decarbonisation of elements outside of the LAEP's energy system boundaries are taken into account, will still result in a target regional net zero date of 2034. The elements included in the Routemap but not the LAEP are: LULUCF and agriculture; negative emissions; industrial emissions not related to building fabric and heating; transport demand reduction, modal shift and public transport; and circular economy activities. The pathways to net zero bring an abundance of opportunities to stimulate the local economy and create local employment.

Pathways

Pathways have been developed for each of the LAEP areas and identify the key projects and decision points on the route to a net zero energy system. Some key short-term aspects of these pathways are*:

- Begin roll-out of building fabric measures and heat pumps to rural, off-gas grid dwellings.
- Begin to replace gas boilers with heat pumps in dwellings outside of urban areas.
- Begin roll-out basic building energy efficiency upgrades for dwellings, starting with a focus on social housing and fuel poor areas, with a view to scale up to owner-occupied dwellings.
- Develop a scheme to widely deploy rooftop PV.
- Provisions to enable and encourage the installation of electric vehicle chargers at dwellings, public spaces, workplaces and commercial destinations.
- Provide suitable land to be developed for large scale renewable generation projects.
- Decide the scale of proposed district heat networks.

As part of the pathway to net zero, some near-term projects have been identified for further feasibility study or 'low regret' deployment.

* Note: Not all of these are applicable to all areas, these are simply a snapshot of some of the steps of the various pathways.

Buildings

Across the York & North Yorkshire region, there are approximately 386,000 dwellings. To reach a net zero energy system, around 216,000 of them will require energy efficiency upgrades to reduce the amount of energy being used to heat them. This is in addition to commercial and industrial buildings. The 216,000 dwellings requiring energy efficiency upgrades are split across the region with 71,000 dwellings in 'Harrogate & The Dales', 61,000 in the A1 Corridor, 44,000 in City of York, and 40,000 in 'The Vale, Moors & Coast'.

The level of energy efficiency upgrade is not consistent across the LAEP areas with older dwellings with solid walls requiring 'deep' upgrades e.g. solid wall insulation, triple glazing, door upgrades etc. More modern dwellings typically require only 'basic' upgrades e.g. loft insulation, cavity wall insulation, draughtproofing etc.

Flats pose a different challenge to houses in that they often aren't able to install loft insulation, wall insulation, floor insulation as a single dwelling within a block. Therefore, these have been excluded from receiving energy efficiency upgrades as part of this report. Yet, options are available where flats can be considered as blocks and loft insulation added to top-floor dwellings, floor insulation added to ground-floor dwellings, and wall insulation added to the building as a whole. Similarly, heating systems can be considered on a block-level rather than individual to increase the cost-effectiveness and reduce the space requirement for equipment in each flat.

Energy efficiency upgrades were found to be 'low regret' almost universally under all scenarios modelled. There is also no upper limit to the amount of energy efficiency upgrades that should take place – they simply become less cost-effective in some circumstances – yet, they always have benefits to the energy system as a whole by reducing the peak demand, as well as reducing energy bills for the occupants and often improving comfort and health outcomes.

All newly built dwellings are expected to be designed and constructed to a standard where they are not going to require insulation upgrades before the chosen net zero target. There is also an opportunity to bring forward the use of low carbon heating systems for new builds from the current 2025 date, to avoid more expensive retrofitting at a later date.

In total, domestic building fabric upgrades are expected to be a large proportion of the cost of achieving a net zero energy system in York & North Yorkshire. For 'The Vale, Moors & Coast' the cost will be approximately £110m (an average of around £2,760 per dwelling upgraded, although the cost for a specific dwelling will vary significantly depending on its individual requirements). However, this is the lowest of the LAEP areas with City of York, A1 Corridor, and 'Harrogate & The Dales' expected to cost around £185m (£4,200/dwelling), £235m (£3,850/dwelling), and £450m (£6,500/dwelling) respectively.

In total, almost £1bn is required to upgrade the energy efficiency of the housing stock across York & North Yorkshire.

Heating

The decarbonisation of heat is one of the greatest challenges in the transition to net zero. Low carbon heating technologies have improved significantly over recent years with regards to their market penetration, consumer awareness, and cost. Compared to the more 'traditional', higher emission forms of heating, they are still very much on the periphery. This outlook is required to change significantly in order for York & North Yorkshire to achieve a net zero energy system.

Currently, the predominant heating system in each LAEP area is fossil gas boilers. In the City of York, this accounts for over 90% of all heating systems currently installed in dwellings. Across the 'The Vale, Moors & Coast' and 'Harrogate & The Dales' areas, the proportion is lower, yet still very high, at 77% and 76% respectively. The A1 Corridor has the lowest proportion of fossil gas boilers at 55% of dwellings.

Oil boilers are the second most common heating system currently across York & North Yorkshire, with as many as 15% of dwellings getting their heating from this technology in 'Harrogate & The Dales'.

To decarbonise these dwellings, air source heat pumps (ASHPs) are the most likely technology to be installed. ASHPs use the heat from the ambient air to evaporate a refrigerant which is then compressed, increasing its temperature. This heat is then extracted for use in the dwelling, making the refrigerant condense ready to go around the cycle again.

This process makes ASHPs, and ground source heat pumps (GSHPs, which work in the same way but use heat from the ground rather than the air), incredibly efficient, getting 3-4 times the amount of heat out than the electricity put in.

The deployment of heat pumps will be substantial – with around 355,000 needing to be deployed across York & North Yorkshire by 2040. The largest proportion of the installations will take place in the 'Harrogate & The Dales' LAEP area, with 124,000 being required. A further 92,000, 77,000 and 62,000 will be needed in the A1 Corridor, 'The Vale, Moors & Coast', and City of York LAEP areas respectively.

Although lower in population, the rural off-gas areas are 'low regrets' i.e. those that will need to transition to heat pumps regardless of developments in other low carbon heating technologies.

District heat networks (DHNs) are systems of highly-insulated pipes carrying hot/warm fluid. This can then heat hundreds or thousands of buildings in an area in a cost-effective way. DHNs can also be low or zero carbon depending on the way in which the heat is generated e.g. large heat pumps or waste heat from industry. For a DHN to be cost-effective, there needs to be a high number of buildings requiring heat in a small area i.e. a 'high heat density'.

Therefore, DHNs are expected to be deployed in dense urban areas such as York and Scarborough. DHNs in York and Scarborough could heat 20,000 and 11,000 dwellings respectively, in addition to many non-domestic buildings in the vicinity. Smaller DHNs have been considered for more densely packed parts of 'Harrogate & The Dales' and A1 Corridor, for example, in Northallerton.

For non-domestic buildings much of the space heating can be decarbonised using heat pumps, however there is a sizeable proportion of high-temperature and/or process heat required where heat pumps are not going to be suitable. Before the mid-2030s and potentially longer term, this is an issue as hydrogen will not be available at scale, meaning that this part of the economy will continue to rely on fossil gas and produce carbon emissions. If decarbonisation is required before hydrogen is available at scale, on-site generation of hydrogen via electrolysis could be considered although it is likely to be at a higher cost than fossil gas.

After the mid-2030s, hydrogen is expected to become a viable option to decarbonise the remaining non-domestic buildings. Assuming that hydrogen infrastructure is sufficiently developed beyond the mid 2030s, it may also be worth considering extending the hydrogen offering to nearby dwellings.

Transport

Sales of plug-in cars and vans in the UK are growing rapidly, with 1 million plug-in cars on the road in 2022. The number of chargepoints is also growing quickly; at the end of September 2022, there were 34,860 charging points across the UK which is a 36% increase compared to September 2021.

Even though sales of electric cars and vans are growing, to meet the Sixth Carbon Budget commitment, ending the sale of Internal Combustion Engine (ICE) vehicles in 2030 to ultimately meet the net zero emission target by 2050, bold and aggressive rollouts of vehicles and infrastructure are needed. This will need to be even more aggressive locally to meet earlier net zero targets.

Transport for the North scenarios* anticipate all 514,000 cars and vans in Y&NY will be 100% electric by 2050. To achieve net zero earlier than 2050, the transition to 100% electric vehicles would need to be brought forward to be in line with the net zero energy system date significantly increasing the difficulty of meeting the target.

Once fully electric, these vehicles will consume approximately 840 GWh of electricity per year across the whole region.

Delivering a chargepoint network that is visible, accessible, connected, secure and interoperable will be vital in giving users confidence in transitioning to electric mobility. Furthermore, public charging infrastructure will need to be built ahead of the mass market transition as it will create the right conditions to enable it. The EV Energy Taskforce made a series of recommendations on how to enable the roll out of charging infrastructure ahead of need; from options for financial support including blended public and private capital and utilisation-linked loans, to anticipatory distribution network investment, underpinned by local area energy plans and support for local authorities in the form of tools and resources.

The charging infrastructure mix is expected to be diverse to be able to meet user needs. It is still expected that where available at home, off-street charging will cover the majority of charging needs. The mechanisms for deploying off-street charging for rental and council owned properties will need to be explored to encourage at home charging.

For users without access to off-street parking a range of solutions might be available. On-street slow chargepoints, slow chargepoints at secure car parks and local rapid hubs are all options that are being explored and deployed across the country. Suitability of each type of near home charging is dependant on a range of factors. Local resident preferences are a critical factor; from private users to fleet or van drivers, their charging needs, and therefore the charging infrastructure they will need vary. Land and network connection cost and parking availability are among factors that could make one area more appealing than the other. This highlights the need for local area assessments that consider local resident needs, network constraints and transport demands.

Other public chargepoint locations such as shopping centres and supermarkets will also support users and will complement home and near home charging. Finally, a network of rapid charging at motorways and major A roads will also be needed to support longer journeys and fleet vehicles.
In all cases the exact number and type of chargepoints will be influenced by user behaviour and preferences. Changes in how users travel will affect the charging infrastructure needed. Moreover, shifting to a mobility as a service model would require a different set of chargepoints to be rollout. Finally, the length of time vehicles are parked at a chargepoint will also affect the number of chargepoints needed.

* https://transportforthenorth.com/future-travel-scenarios/

Local Generation

To decarbonise heat and transport across York & North Yorkshire, a significant number of heat pumps need to be deployed and electric vehicles purchased. Both of these technologies will require large amounts of zero carbon electricity to ensure that they are not producing emissions. However, the scale of deployment and therefore the demand for electricity in the region is expected to occur ahead of the decarbonisation of the national grid in 2035. This means that zero carbon electricity will need to be generated locally in order to meet the demand.

The electricity demand is likely to have increased by between 21% in the 'The Vale, Moors & Coast' region and 68% in the City of York by 2040 when compared to current levels.

In the LAEPs for each area, rooftop and ground-mounted solar have been considered to demonstrate the scale of local renewable capacity which would decarbonise the York & North Yorkshire region ahead of the country as a whole. A high-level assessment was also conducted to give an indication of the maximum contribution of onshore wind to the future energy system.

Domestic rooftop solar could provide a large contribution. It is estimated that around 320 MW of rooftop solar capacity would be cost-optimal (subject to full feasibility and site visits) in the City of York with a further 163 MW in 'Harrogate & The Dales', 159 MW in the 'The Vale, Moors & Coast, and 123 MW in the 'A1 Corridor'. Collectively therefore, there is the potential for around 765 MW of domestic rooftop solar PV capacity across the region. Deploying all of this capacity would cost upwards of £600m. At the time of writing (Autumn 2022) however, the cost of domestic solar PV is being driven by the increased cost of importing panels, their scarcity as people look to reduce their reliance on 'grid bought' electricity, and increased installation costs due to the high demand. There are also obvious social benefits to installing domestic solar PV, especially for residents in fuel poverty who would immediately see a reduction in their electricity bills. By adding in-home battery storage, more of the generated electricity could be consumed by the household, reducing the reliance on the network during peak times and reducing the amount of electricity purchased. The economic case for batteries can be marginal in the 2022 energy market, but is likely to change with the emergence of novel incentives such as time-of-use tariffs, falling battery costs, and additional increases in electricity prices.

Large-scale solar farms are also considered to be a cost-effective way of generating significant amounts of zero carbon electricity. Indeed, due to their scale, they are often the most cost effective. Within York & North Yorkshire, there are many land parcels which – using our high-level method of identification – seem to be worthy of further investigation.

If the land areas identified are deemed to be suitable, 512 MW (10% of maximum potential) of ground-mounted solar could be deployed in 'The Vale, Moors & Coast', 890 MW (88% of maximum potential) within the City of York boundary, 547 MW (5% of maximum potential) in 'Harrogate & The Dales', and 609 MW in the A1 Corridor could be deployed. Together with 346 MW of onshore wind deployment in 'The Vale, Moors & Coast', 666 MW in 'Harrogate & The Dales' and 318 MW in the A1 Corridor, and the rooftop solar deployment, York & North Yorkshire could generate as much electricity as it requires on a net annual basis.

There are concerns though about what this amount of generation would do to the electrical network, since the power would be predominantly generated in mid-summer when heat pumps are not required for heating and therefore demand is low. Currently, seasonal storage for this quantity of electrical power is not deployable.

Networks

Electricity Network & Flexibility

To meet the new demand from electric heating and transport, there will be a need to upgrade the electrical network, since total peak electricity demand could increase to as much as 2.5x current levels. The high and low voltage networks may have sufficient capacity to accommodate most or all of the electrification in this plan in some areas, but many areas are likely to see a need for capacity upgrades.

In these LAEPs, network costs are estimated based on meeting increased demand with capacity upgrades, however it may be possible for flexibility services to reduce the investment required in conventional capacity upgrades.

Smart appliances which can shift the times they use electricity without any loss in performance (particularly EV chargers and heat pumps) can provide this flexibility.

Gas Network & Hydrogen

Although much of the current fossil gas demand for heating is expected to become electrified across the whole York & North Yorkshire region, the gas network still has an important part to play in the future energy system. As highlighted earlier, there are some areas of the non-domestic sector that will be hard to electrify and therefore will remain on fossil gas in the short-to-medium term before considering a transition to hydrogen in the mid-2030s. This provides an opportunity for nearby properties to also connect to a hydrogen network if they are yet to transition to an electrified heating technology.

However, many of the proposals for hydrogen will depend on the Government's policy position which they are expected to lay out in 2026.

Introduction

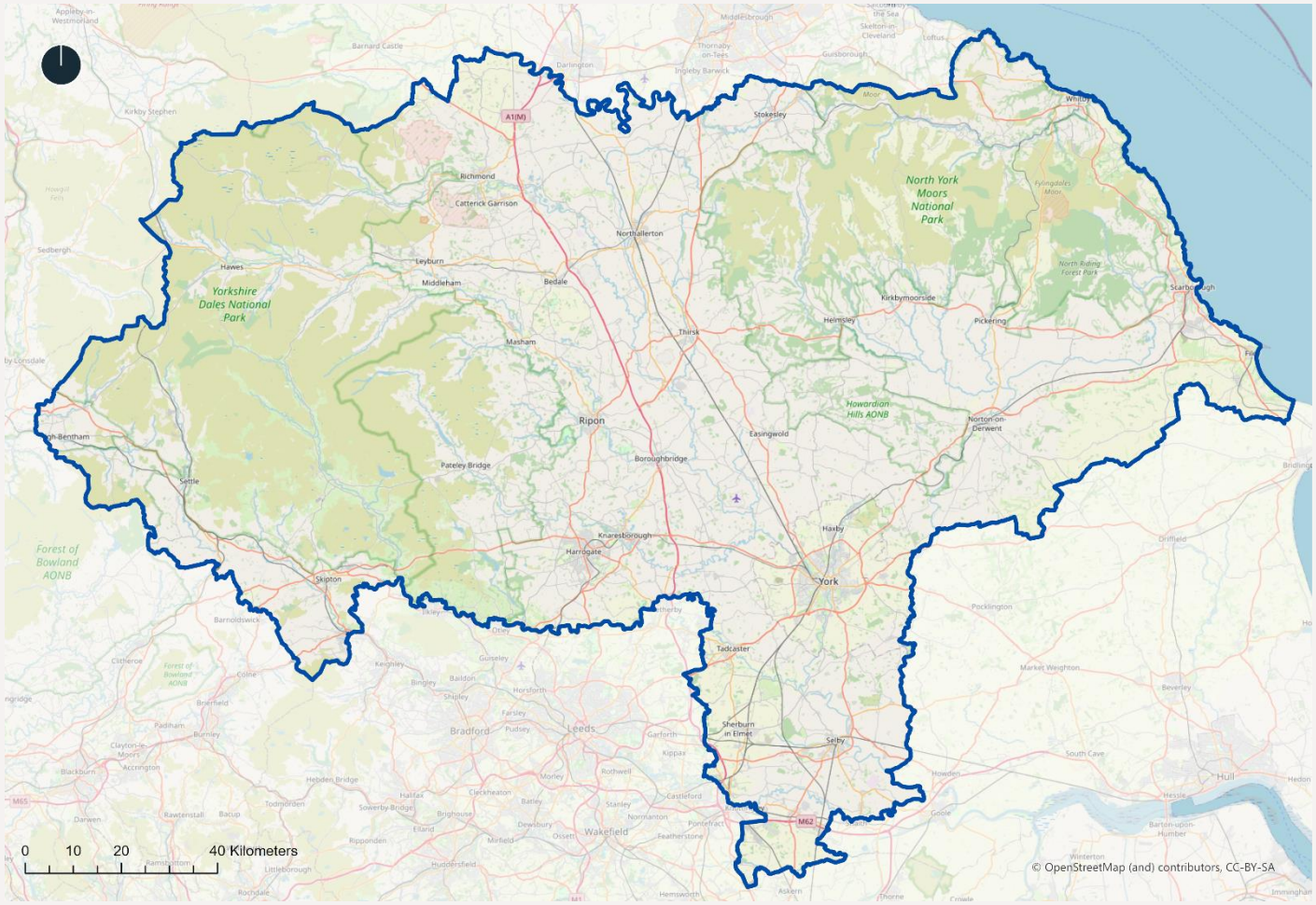
Introduction

Four Local Area Energy Plans (LAEP) have been produced for North Yorkshire and the City of York Council. The purpose of the LAEPs are to support the Y&NY region in meeting its net zero and carbon negative goals, enabling transition to an affordable and decarbonised energy system as well as supporting wider socio-economic goals.

The Y&NY LEP has set an ambitious target of achieving net zero by 2034 across the whole region, and to be England's first 'net negative' region by 2040. These ambitious targets put the Y&NY region well ahead of the national plan to achieve net zero by 2050.

North Yorkshire covers a large and predominantly rural area with two National Parks as well as densely urban areas such as the City of York. It covers a total of 8,325km^2, and is home to over 800,000 people. The geographic area covered by the LAEPs is shown in the figure (right).

Previous work focussed on the region has helped the Y&NY LEP, City of York Council, and other stakeholders understand the scale of the challenge to reach net zero. Undertaking LAEP builds on the existing strategies and action plans within the region and takes these to a spatial level to identify what changes needed to be made and where.



A further benefit of local area energy planning is the 'whole systems approach' which allows a future energy system to be considered which is most cost-effective as a whole, e.g. deploying different heat decarbonisation technologies to avoid a high-cost upgrade of the electricity network.

By working closely with local stakeholders, incorporating their data, knowledge and future plans, a LAEP is built on a common evidence base. The outputs can then be used reliably by stakeholders from council planners to network operators to community groups, knowing they are working towards a common goal built on strong foundations.

What is a LAEP?

A LAEP sets out the change required to transition an area's energy system to net zero in a given timeframe. This is achieved by exploring potential pathways that consider a range of technologies and scenarios, and when combined with stakeholder engagement leads to the identification of the most cost-effective preferred pathway and sequenced plan of proposed actions to achieving an area's net zero goal.

The scope of the LAEP covers the current energy consumption and associated greenhouse gas emissions, as well as the projected consumption in a defined area to 2050, primarily focussing on the area's built-environment (all categories of domestic, non-domestic, commercial, and industrial buildings) and some aspects of energy used for transportation.

A LAEP provides a level of detail comparable to an urban masterplan. It provides a proposed future plan for an area rather than providing a detailed schematic that sets out how each part of the area would be designed and built. More detailed work would be required to deliver specific elements of a LAEP[1].

Definition of LAEP[2]:

- LAEP is a data driven and whole energy system, evidence-based approach that is led by local government developed collaboratively with defined stakeholders. It sets out to identify the most effective route for the local area to contribute towards meeting the national net zero target, as well as meeting its local net zero target.
- LAEP results in a fully costed and spatial plan that identifies the change needed to the local energy system and built environment, detailing 'what, where and when and by whom'.
- LAEP provides the level of detail for an area that is equivalent to an outline design or master plan; additional detailed design work is required for identified projects to progress to implementation.
- LAEP defines a long-term vision for an area but should be updated approximately every 3–5 years (or when significant technological, policy or local changes occur) to ensure the long-term vision remains relevant.
- LAEP identifies near-term actions and projects, providing stakeholders with a basis for taking forward activity and prioritising investments and action.
- LAEP scope addresses electricity, heat, and gas networks, future potential for hydrogen, the built environment (industrial, domestic, and commercial) its fabric and systems, flexibility, energy generation and storage, and providing energy to decarbonised transport e.g., electricity to electric vehicles and charging infrastructure.

[1] As an example, a LAEP identifies a zone that is best suited to a district heat network by assessing the types of buildings in the zone, their characteristics, and density; however, to deliver the district heat network it would require a full feasibility assessment by an appropriately qualified installation / design company, along with assessment of commercial viability and delivery mechanisms.

[2] https://es.catapult.org.uk/report/the-future-of-local-area-energy-planning-in-the-uk/ and https://es.catapult.org.uk/guide/guidance-on-creating-a-local-area-energy-plan/

[3] A number of emissions sources are not included in the scope of a LAEP, but are included in the Routemap to Carbon Negative, including: land use and agriculture, negative emissions, industrial emissions not related to building fabric and heating; transport demand reduction, modal shift and public transport; and circular economy activities

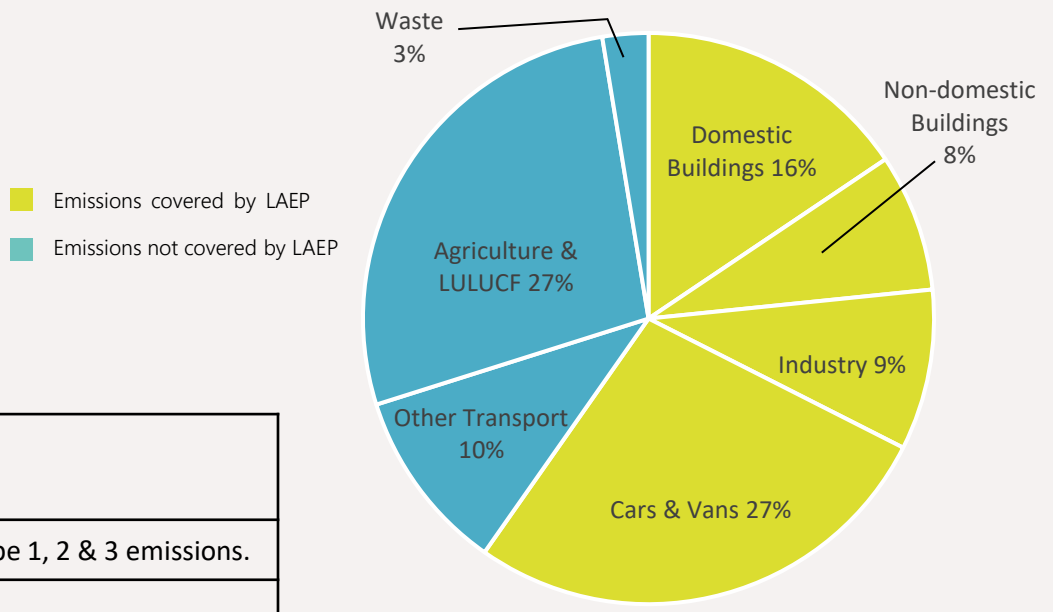
Note: Some technologies such as batteries, storage, wave and hydro, and offshore wind have not been included in the LAEP modelling. It is likely that these technologies will play an important part of the future energy mix of both the local area and the UK as a whole.

Emissions and Net Zero Targets

In 2020, the Y&NY region's emissions totalled 7.7 $MtCO_2e$[1]. The chart (right) shows Y&NY region's emissions broken down according to their sources, such as buildings and transport. To be a net zero region by 2034, all of these emissions must be eliminated, not just those covered by this LAEP.

The Y&NY region currently comprises several local authorities and other regional bodies that each have their own targets relating to net zero as outlined in the table below. After April 2023, these local authorities will merge as part of local government reorganisation and emissions targets will need to be agreed by the proposed North Yorkshire Council.

Approximate proportion of Y&NY's 2020 CO_2 emissions covered by this LAEP



Local Authority	Climate Emergency Declared	Targets
Craven District Council	Yes	Carbon neutral by 2030 including scope 1, 2 & 3 emissions.
Hambleton District Council	No	Carbon neutral by 2030.
Harrogate Borough Council	No	Aligned to the West Yorkshire Combined Authority target of net zero by 2038.
Richmondshire District Council	Yes	Net zero carbon Council by 2030, whole district by 2034.
Ryedale District Council	Yes	Net zero carbon emissions by 2050.
Scarborough Borough Council	Yes	Carbon neutral by 2030.
Selby District Council	No	Carbon neutral before 2050, with aspirations of achieving this by 2030.
City of York Council	Yes	Net zero carbon emissions by 2030.
North Yorkshire County Council	Yes	Net zero Council by 2030.
York & North Yorkshire LEP	No	Net zero region by 2034 and net negative by 2040.
Yorkshire Dales National Park Authority	Yes	95% reduction by 2030 (2005 baseline)

The delivery of these plans will require all stakeholders in the areas to work towards the collective goal of net zero. The local authorities and other regional bodies are likely to be best placed to convene experts including the network operators, community groups, investors, and delivery partners under a governance structure to take forward the recommendations in these LAEPs through to delivery.

The graph on the next page shows all emissions (i.e., everything in the chart above) as pathways out towards net zero.

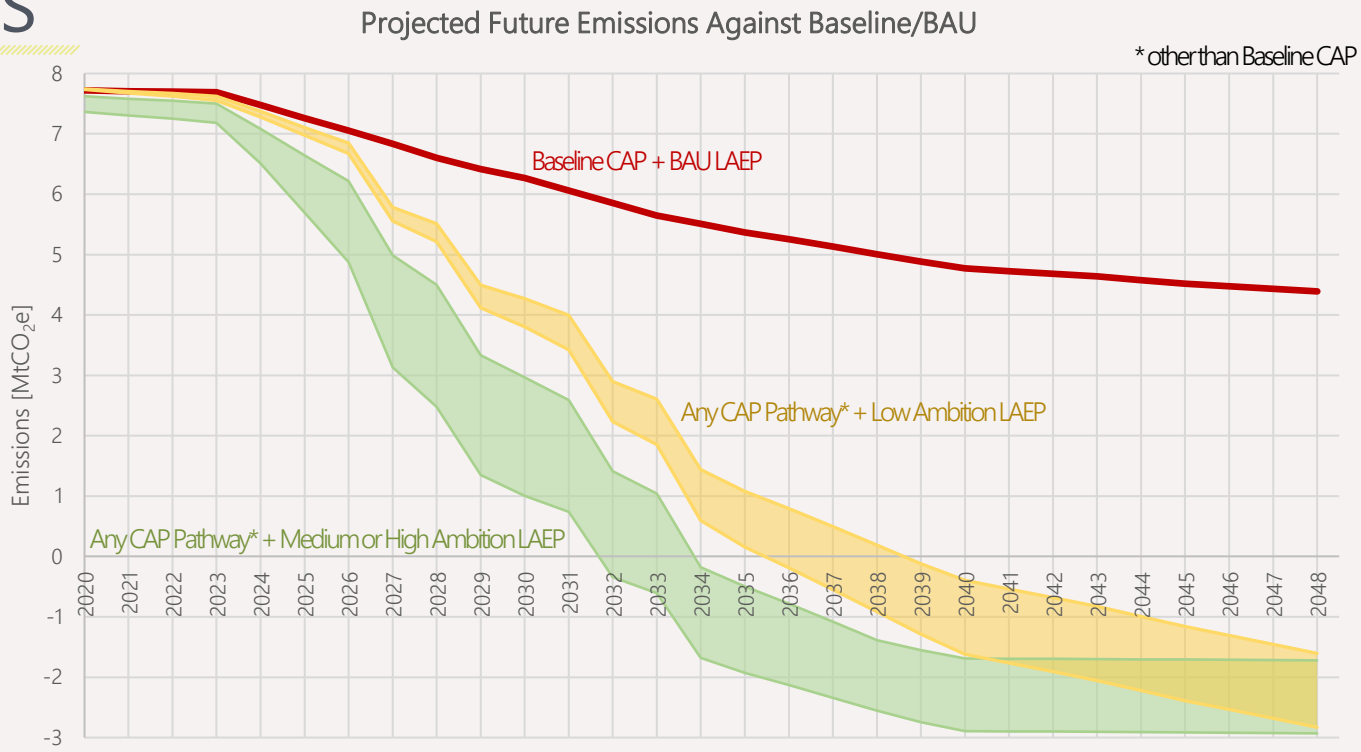
[1] CO_2e represents an amount of a greenhouse gas emissions whose atmospheric impact has been standardized to that of one unit mass of carbon dioxide (CO_2), based on the global warming potential (GWP) of the gas. Mt is millions of tonnes.

Emissions Pathways

In creating local area energy plans for North Yorkshire and City of York, a number of future scenarios and emissions trajectories have been considered in combination with the Carbon Abatement Pathways (CAP). North Yorkshire and City of York therefore have multiple pathways to follow to reach their goal of net zero by 2034 and to become the first net negative region in England by 2040. The CAP are named 'Max Ambition', 'High H2' 'Balanced', and 'Baseline'; ESC has used 'High', 'Medium' and 'Low' ambition.

The 'Low' ambition scenario progresses slower than the region's ambitions, aiming to achieve a net zero energy system by 2050 – aligned with the national net zero target of 2050. The 'Medium' ambition pathway aims to achieve a net zero energy system by 2040, and 'High' ambition aims to achieve a net zero energy system by 2030.

When these pathways are combined, only the 'Baseline' CAP and the 'Low' ambition LAEP scenarios fail to meet net zero in time to meet the 2034 net zero target. The 'Low' ambition scenarios do however still reach net negative before 2040.



In the graph, above, the green area represents the combinations of CAP and LAEP pathways that would reach net zero by 2034 – in line with the Y&NY target. The yellow area represents areas that reach 'net negative' by 2040, but miss the 2034 net zero target. These are compared against a red line which represents the status quo in both the CAP and LAEP pathways.

The LAEPs will therefore focus on a 'Medium' ambition scenario unless otherwise stated, as this, plus a 'Balanced' pathway from the CAP will produce a net zero Y&NY region in 2034.

Each scenario has associated early actions and long-term scale-up activities to reach the target in a cost-effective way, along with key enabling actions and decision points to stay on track and navigate future uncertainty.

In the near-term, the LAEPs illustrate the proposed activities for the region to progress towards net zero by identifying 'easy wins', 'focus zones' and specific 'outline priority projects' which could be taken forward into a feasibility stage.

It should be noted that the CAP includes negative emissions from carbon capture and storage at the Drax power station to offset emissions elsewhere. Since ESC considers the Drax power station to be a 'national asset' rather than a local one, the power generated and its associated emissions are considered to be accounted for at a national level. This therefore produces an inconsistency as any negative emissions, in ESC's opinion, would also be accounted for at a national level.

https://www.ynylep.com/Portals/0/adam/Stories/VqQDBytZGUuDihbMTz2ZZQ/Body/North-West-Yorkshire-Emissions-Reduction-Pathways.pdf

The figures in the Routemap to Carbon Negative fall within the green area of the graph above. This is due to the figures in the majority being from the Max Ambition CAP scenario with some elements of the other pathways.

Creating North Yorkshire & City of York LAEPs

The Y&NY region was broken into four sub-regions to align with the criteria of the Community Renewal Fund (CRF).

These sub-regions are:

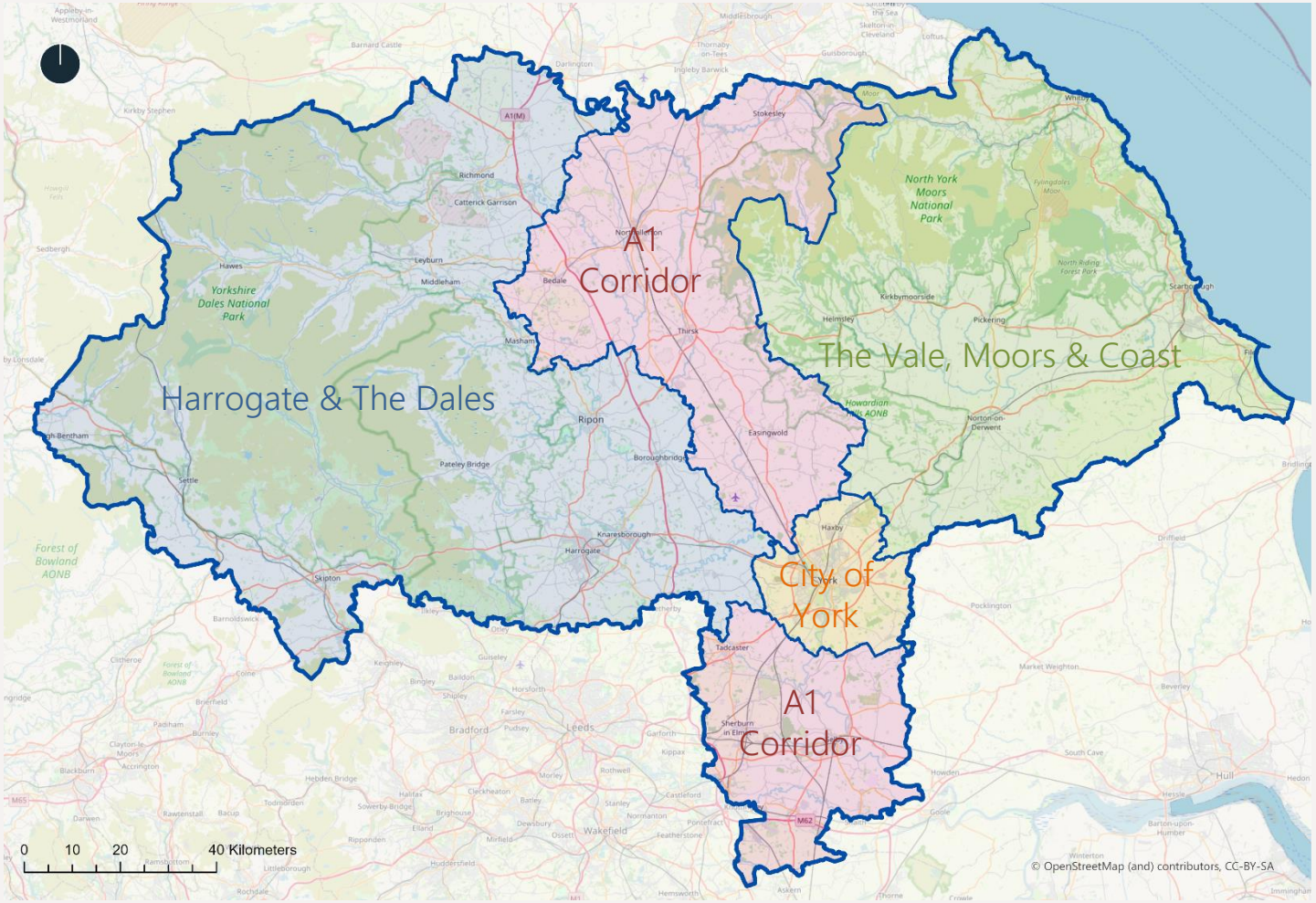
- A1 Corridor (pink)
- The Vale, Moors & Coast (green)
- Harrogate & The Dales (blue)
- City of York (yellow)

These were then sub-divided into several 'zones' to allow for a better understanding and assessment of options for decarbonisation.

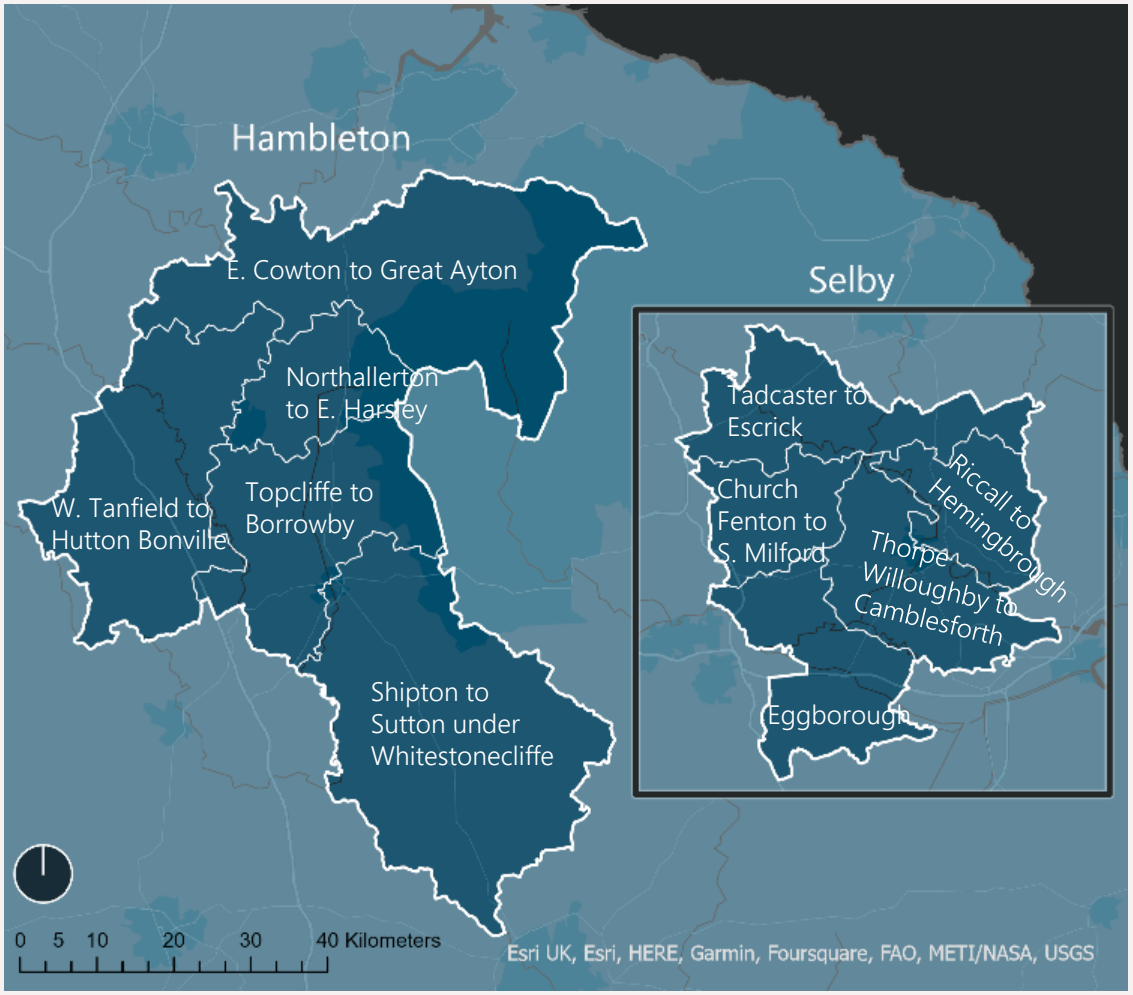
Zones for analysis were identified based on areas served by primary substations, using data provided by the electrical network (Northern Powergrid) that identifies buildings connected to secondary substations that are in-turn connected to each primary substation.

The zones therefore do not follow other standard geographical boundaries such as LSOAs, MSOAs, constituencies, or electoral wards.

The following four sections of this report provide further detail on the LAEPs for each of the sub-regions.

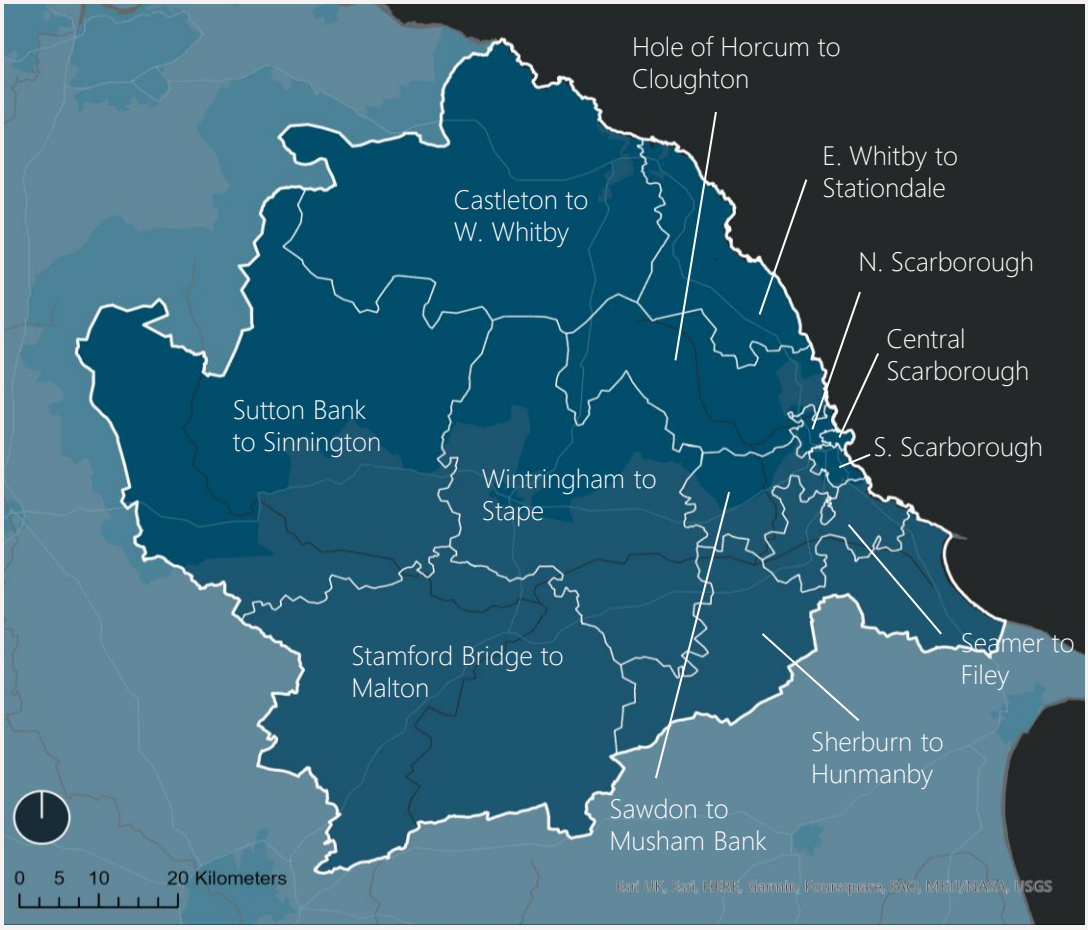


Zones – A1 Corridor and The Vale, Moors & Coast

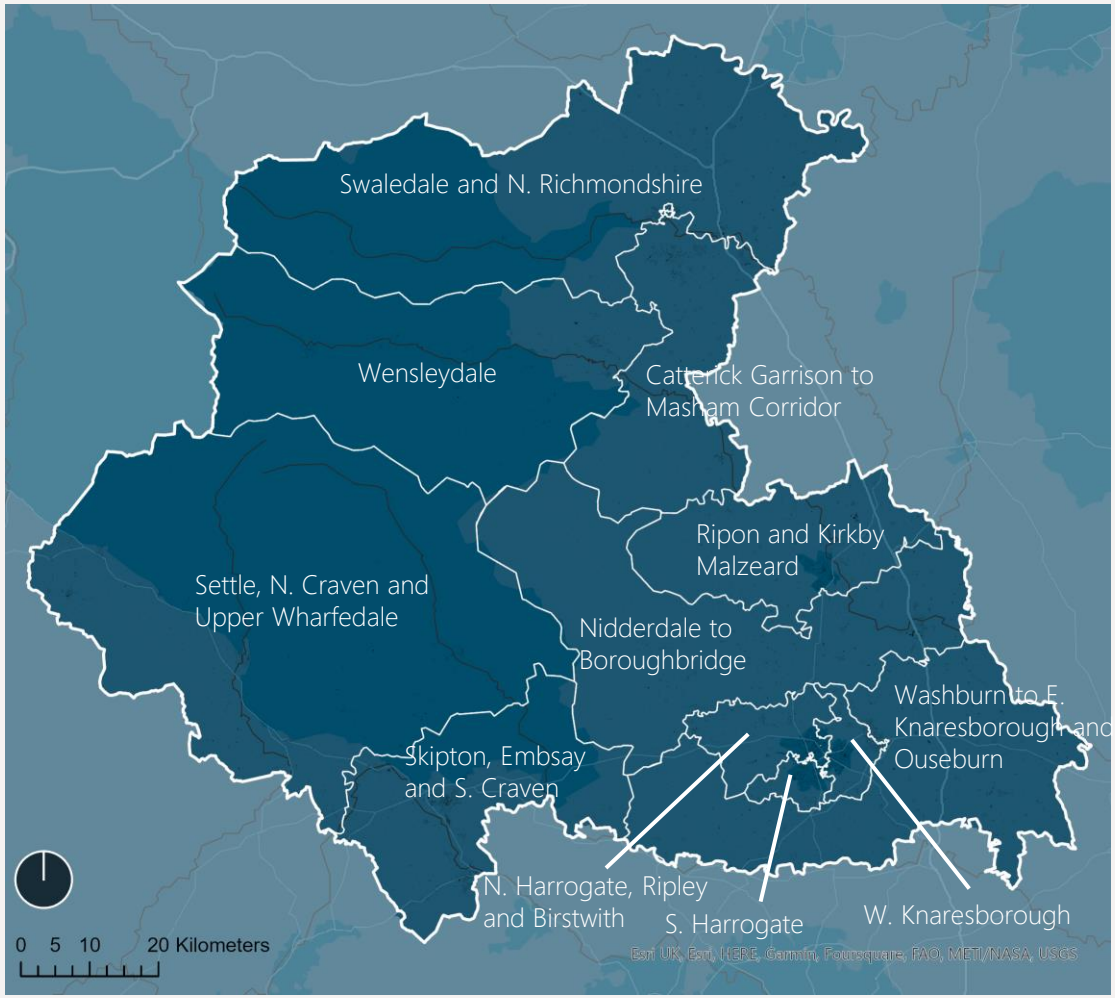


Zones of the A1 Corridor (above)

Zones of the The Vale, Moors & Coast (below)



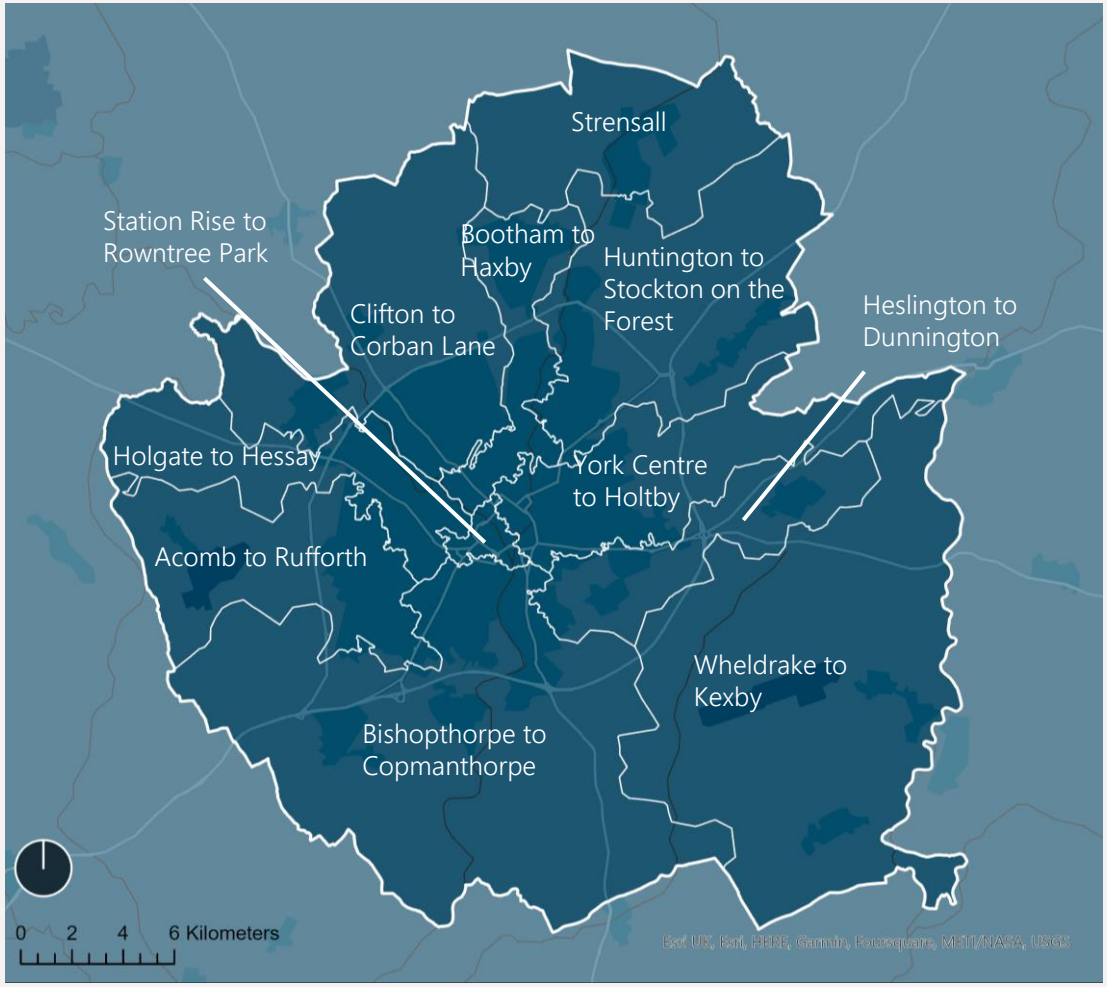
Zones – Harrogate & The Dales and City of York



Zones of the Harrogate & The Dales (above)

"The Dales" refers to the current council areas of Richmondshire and Craven.

Zones of the City of York (below)



A1 Corridor

Local Area Energy Plan

CATAPULT Energy Systems

York & North Yorkshire LOCAL ENTERPRISE PARTNERSHIP

HM Government

LOCAL AREA ENERGY PLAN

The Vale, Moors & Coast

Local Area Energy Plan

CATAPULT Energy Systems

York & North Yorkshire LOCAL ENTERPRISE PARTNERSHIP

HM Government

LOCAL AREA ENERGY PLAN

Harrogate & The Dales

Local Area Energy Plan

CATAPULT Energy Systems

York & North Yorkshire LOCAL ENTERPRISE PARTNERSHIP

HM Government

LOCAL AREA ENERGY PLAN

City of York

Local Area Energy Plan

CATAPULT Energy Systems

CITY OF YORK COUNCIL

LOCAL AREA ENERGY PLAN

Implementation

Overview of Implementation

Recognising the scale of the transition needed to support Y&NY region's net zero ambitions, the LAEPs are broken down into:

- Near-term components made up of "Quick Wins" which can be carried out in the near-term without major blockers, and "Low Regrets" projects which are common under various scenarios but may require further enabling action before they can be progressed
- Long-term components made up of "Enabling Actions" which need to be carried out ahead of time to pave the way for later solutions, and "Decision Points" where the most appropriate solution is chosen at some point in the future once more information is known. These decision points may be needed before widespread scale-up and deployment of solutions.

Some of these are summarised opposite, which along with other components feed into The Pathway. The Pathway is followed by a series of Next Steps which highlight the aspects the Y&NY region should consider to progress the LAEPs; working with the Key Stakeholders to determine roles in supporting the implementation of these LAEPs.

QUICK WINS	LOW REGRETS	ENABLING ACTIONS	DECISION POINTS
Energy efficiency upgrades in social housing.	EV charger roll-out for those with off-street parking.	Investigate financial models to encourage solar uptake.	Scale of the district heat network (where applicable).
Install solar PV on council buildings and land.	Energy efficiency upgrades and heat pumps in rural off-gas grid areas.	Work with experts to plan the DHNs and establish a business case.	Off-street EV charging at hubs, kerbside charging, or other.
Roll-out public charging infrastructure.	Ground-mounted PV deployment on land of low arable quality.	Develop ownership and finance models for low carbon generation.	Extension of hydrogen into dwellings near to industrial uses.
Replacement of council fleet vehicles with EVs.	Energy efficiency upgrades for private rental dwellings.	Information and engagement campaign around heat pumps.	Local and political appetite for large solar and onshore wind.

Next Steps

Taking LAEP Forward

The local area energy plans (LAEPs) for the Y&NY region have highlighted initial 'low regret' outline priority projects for consideration. In order to take these projects forward and assess the role the local authorities in the proposed combined authority and the LEP wish to play in the future low carbon energy system, ESC has developed an initial approach illustrated on the next page, followed by specific actions.

Prioritise

The first stage recommends stakeholders work to prioritise the projects identified within the LAEPs and commission desktop feasibility studies to assess their viability in meeting the regional aims and objectives. Prioritisation of the LAEP projects should be influenced by areas currently within direct control, for example social housing or land assets and public buildings owned by the councils. Resources are available at Net Zero Go[1] to assist with this.

Projects should then be assessed in line with regional targets to assess impact on fuel poverty, air quality, local economic growth plans, etc.

Prioritisation should also include understanding the role each tier of local and regional government wishes to play as decarbonisation projects are further developed.

For example, they could work with partner organisations to assess their risk profiles, and desired roles in any future energy system before matching outcomes against different types of local energy business models. Prioritised projects should subsequently undergo desktop feasibility studies to assess their viability and to understand the low carbon interventions and renewable technologies required in further detail. This could include sizing commercial renewable technologies, assessing co-located storage options, consideration of network connection requirements and an initial outline business case.

Assess

In the next phase of energy project development, various options can be assessed with the aim of exploring investible delivery mechanisms. Dependent on project type, a partner organisation with experience of innovative business modelling can assess how technologies can be connected and delivered to residents in a way that matches the risk profile of each stakeholder and the role they wish to play. This could include assessing different types of Smart Energy Tariffs that incorporate costs for retrofit for social housing, exploring ways for councils to invest into infrastructure projects while ensuring commercial revenues are secured or assessing business models where the councils are off-takers or customers.

Connect

Further consideration should be given to how technologies and projects can be connected together through Smart Local Energy Systems (SLES), which can aggregate to unlock private investment and create numerous co-benefits. Once a firm Capital Investment Plan has been formed and initial sources of investment and funding have been identified, the design phase needs to firm up assumptions made during desktop feasibility.

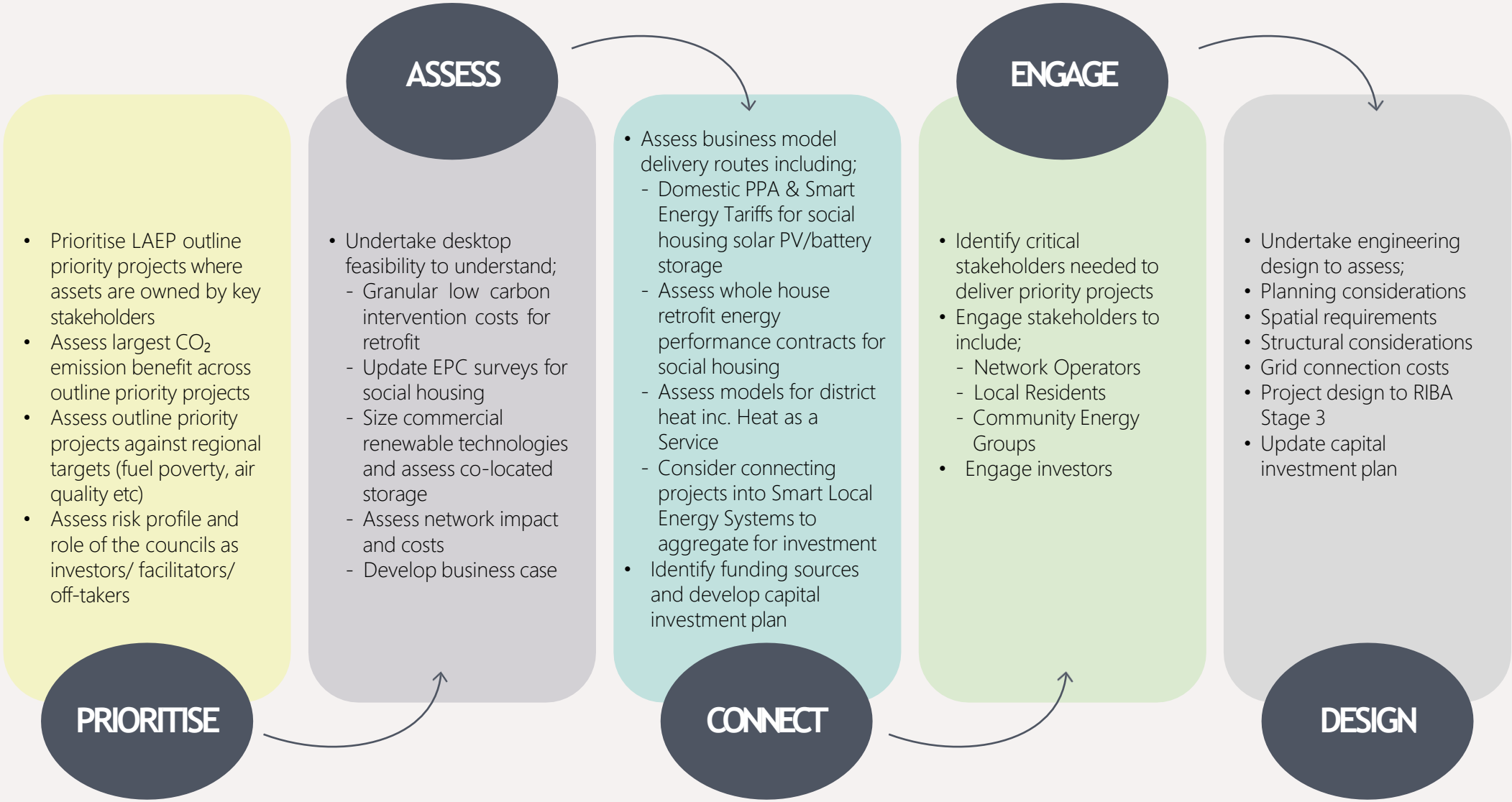
This involves working with partner organisations with engineering expertise to assess spatial, planning and structural considerations. Connection costs should be fully understood and a finalised capital investment plan produced.

Engage

Engagement is another key part of taking outline priority projects identified in the LAEPs forward. Key stakeholders need to be identified and consideration should be given to how residents are consulted and bought into the potential benefits of decarbonising dwellings and estates. A partner organisation with strong digital engagement experience and relationships with network operators can support this process.

[1] https://www.netzerogo.org.uk

Unlocking Investment



Energy Systems Catapult is well placed to help York & North Yorkshire LEP, City of York Council, and other stakeholders to move from LAEP towards design and delivery.

Taking LAEP Forward

Devolution for York & North Yorkshire alongside the creation of the new North Yorkshire Council provides an excellent opportunity to take forward projects identified in these LAEPs. The propsed combined authority could provide a coordinated, centralised approach which learns from previous work in the area and leverages the knowledge, data and skills this has created whilst enabling economies of scale and efficient working.

Creation of a LAEP Delivery Group with leadership groups for different sectors can:

- Help to coordinate actions across the York & North Yorkshire region to drive change.
- Ensure that different aspects of the energy transition are considered together to ensure appropriate action is taken. For example, ensuring that if electricity network reinforcement is required for EV charging, consideration is given to any future requirement to support electrification of heat to avoid two phases of works.
- Provide a central contact point for stakeholders such as gas and electricity network operators and other delivery partners helping them to understand priorities, opportunities and constraints across the area and to work effectively in supporting and delivering the proposed combined authority's vision.
- Enable larger scale procurement to reduce costs.
- Help with identification of skills gaps and provision of local training to fill them.
- Provide opportunities to identify approved and trusted suppliers to support private investment that builds upon public investments.
- Provide a central resource to support local residents when making decisions about their dwellings and travel options.
- Ensure that a consistent approach is taken to tracking progress and updating plans.

As part of this work, creation of a Citizens Panel could be considered to ensure that local communities are engaged in the challenge of reaching Net Zero, feel that their voices have been heard and are supportive of the change required.

Domestic Buildings

The proposed creation of the York & North Yorkshire combined authority provides an opportunity to build on existing local schemes such as Warm & Well in North Yorkshire, which are already delivering help to vulnerable people by addressing cold, damp dwellings, and fuel poverty. Opportunities exist to build on existing partnerships and to take learning from these schemes in areas such as working with local residents, identifying appropriate interventions, and building local supply chains to scale delivery of decarbonisation of dwellings to whole local areas.

Areas where existing local projects and knowledge could be leveraged include:

- Accessing funding through the Local Authority Delivery Scheme, Social Housing Decarbonisation Fund, National Energy Action, ECO and the National Grid Warm Homes Fund.
- Using other funding streams such as Boiler Upgrade Scheme.
- Widening the target clients and areas for activities such as York Energy Advice to cover a wider pool of residents and the whole of York & North Yorkshire.
- Using existing resident contacts from energy efficiency, oil buying and collective switching schemes to target communication around retrofit and low carbon heat schemes. Residents who have been involved in these types of schemes are likely to be more engaged with energy issues and may be more receptive to approaches regarding retrofit and low carbon heating opportunities.
- Comparing across all the different schemes that have been run in local areas to identify best practice and opportunities to share data, methods and approaches to applying for funding.
- Use of social housing asset registers and registers of private landlords (such as HMO registers and landlord forums) to understand these market sectors and identify retrofit options.
- Learning from previous schemes such as 'Hitting Hard' run by Scarborough Borough Council and Richmondshire District Council to build similar schemes across the whole of York & North Yorkshire.

In addition, consideration should be given to:

- Designing schemes for social housing so that a package can be offered to owner-occupied in the same area, with the potential to reduce costs for both housing providers and owner-occupiers whilst also increasing coverage.
- Considering where existing and new schemes can be aligned with the wider energy strategy and targeted towards heat pump and retrofit priority zones
- Applying lessons learnt on supply chains and accessing grant funding from existing schemes to help fuel poor and social housing tenants to scale up to include private rented and owner occupied dwellings.
- Improving understanding of local delivery capacity and identifying skills gaps and associated training needs.
- Considering learning from funding initiatives such as the Energy Repayment, Home Appreciation and Empty Property Loans set up under Hambleton's Private Sector Housing Assistance Policy Funding to help develop future options for similar combined authority schemes.
- A survey of existing MCS registered local suppliers to understand the scale of delivery possible with the existing supply chain.
- Working closely with local network operators to ensure timely delivery of the introduction of low carbon heating systems. For example, experience from BEIS' Electrification of Heat programme is that geographically clustered DNO approvals for heat pumps are easier for DNOs to manage and are processed more quickly than dispersed applications.

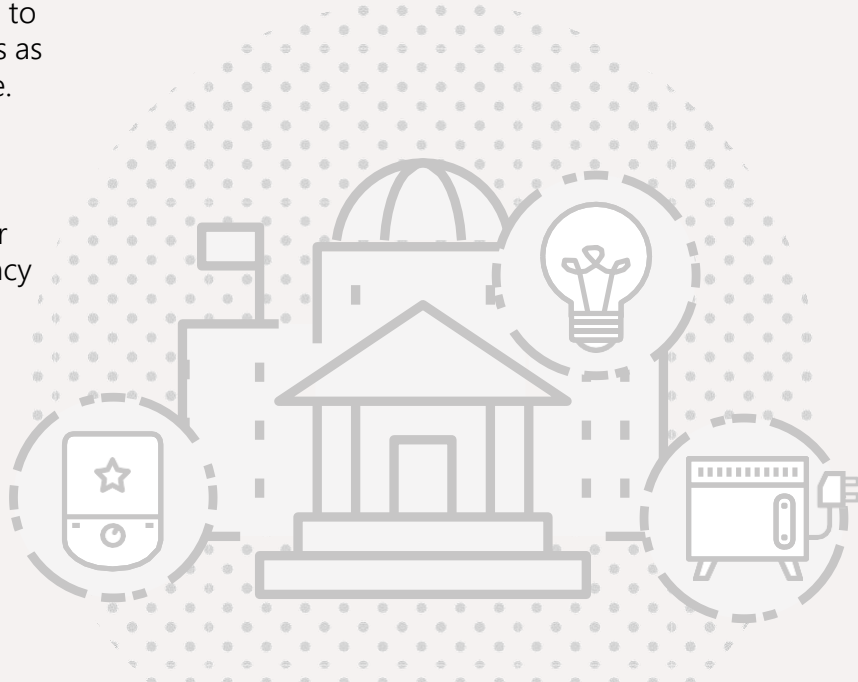
Non-Domestic Buildings

A similar approach to that adopted for domestic buildings can be applied to commercial and public building energy efficiency and decarbonisation, with learning and scaling up from existing projects and programmes to achieve scale. For example:

- Using experience from previous applications to the Public Sector Decarbonisation Scheme (PSDS) to identify approaches that have worked well to improve future applications.
- Developing site decarbonisation strategies in preparation for future PSDS funding rounds.
- Using learning from public sector building energy efficiency and decarbonisation programmes to develop other programmes to support local businesses in their own energy efficiency and decarbonisation.
- Using links with local businesses through the Federation of Small Businesses and West and North Yorkshire Chamber of Commerce to engage them with support programmes to help them decarbonise.
- Considering how local business might be supported to access funding through schemes such as the Renewable Heat Incentive.

In addition, the proposed combined authority should consider a programme to gather better data on commercial and industrial buildings including:

- Construction types
- Current energy use
- Surveying small industry sites to understand the current technologies on all sites and applicability of low carbon options alongside identification of where is hydrogen is likely to be required to generate high temperatures as alternative approaches are not appropriate.
- Exploiting Northern Gas Network's* and National Atmospheric Emissions Inventory data on large gas users, to target particular sites for discussions around energy efficiency and decarbonisation.



* Note that there may be data sharing and commercial considerations which restrict how much of this information can be made available such that a partnership arrangement might be the best approach

Transport and Local Generation

Transport

In order to help enable the switch to electric vehicles and build on local studies, several actions should be considered:

- Providing information on low emission vehicles for car owners. For example, the EV Experience Centre in Milton Keynes provided impartial help and advice on electric vehicles to local residents.
- Focusing on charge points in public locations and areas without off road parking to enable and encourage uptake of electric vehicles.
- Targeting public sector activity and funding towards providing charging infrastructure for rural areas, where the private sector could struggle to build a business case due to lower charge point utilisation and where problems with network constraints or high connection costs could be additional barriers.
- Proceeding with electrification of vehicles owned and operated by local councils starting with cars and vans before exploring decarbonisation options for heavy vehicles (which may use alternative approaches such as BioLNG in preference to electrification).
- Using learning from these schemes to provide help and support to local businesses with understanding options and decarbonising their own vehicle fleets.
- Considering if reduced cost charge points could be offered to local businesses by leveraging investments in publicly funded charge points.
- Working with local bus operators as part of the introduction of bus franchising under the devolution deal to encourage introduction of low emission bus services.
- Working closely with Northern Powergrid (NPg) to ensure that network constraints do not hamper widescale introduction of electric vehicles, and that they are aware of which areas are being targeted for the introduction of electric heat solutions so that planning can account for both changes.

Local Generation

Local, low carbon energy generation is likely to be at a variety of scales from individual domestic solar PV installations to large wind farm and ground mounted solar developments. Several actions can be taken to encourage uptake across this spectrum.

- Understanding the number and size of local suppliers and the scale of delivery possible with the existing supply chain.
- Engaging with residents to understand public attitudes to low carbon generation and to garner support for new installations.
- Identifying funding opportunities and developing schemes to encourage uptake.
- Supporting new community energy schemes by working with existing local schemes and providing contacts, learning and coordination. This could be in combination with the North East and Yorkshire Net Zero Hub.
- Exploring opportunities to leverage investments in solar PV for social housing and public buildings to provide support and to reduce costs for private investments
- Coordinating with NPg to ensure that viable schemes are not held back through problems relating to network connection issues.

Networks, Storage and Flexibility

The most important aspect of taking forward the Y&NY region's LAEPs with respect to energy networks will be ensuring regular communication and coordination with and between network operators to ensure that they are aware of what is planned, where it is planned, and when it is planned to happen. This should provide significant benefits in ensuring that any network preparations that are required to enable different projects do not prevent those projects from progressing. There are also specific actions that should be considered for different individual energy networks.

Electricity Networks

A York & North Yorkshire Local Energy Market* may prove valuable in supporting roll out of heat pumps, electric vehicles, solar PV, energy storage and flexibility across York & North Yorkshire. It is proposed that a project to understand and investigate options is undertaken.

Heat Networks

BEIS' Heat Networks Delivery Unit (HNDU) has funding available for heat network feasibility studies. This should be accessed to progress development in heat network focus areas. It is suggested that the knowledge and experience of local staff who have already worked with HDNU is used to support future work in this area.

It will be important to engage with local sites that have been identified as potential anchor loads or heat providers for heat networks, as well as local resident associations when starting to build the case for new district heat networks. This will ensure that sufficient scale can be achieved to make developments commercially viable.

In the absence of individual site energy demand data, the information used to identify heat network focus zones has been based on a series of assumptions around the energy use of different sites and buildings. It will be valuable to start gathering better energy data from target areas based on their actual energy use. This will be particularly important for larger sites that are likely to be integral to building the business case and technical design requirements of future heat networks.

Gas Networks

Opportunities and timelines for use of hydrogen in the Y&NY region will be heavily dependent on the plans of Northern Gas Networks. It is important that the new proposed combined authority maintains an ongoing discussion with them around these plans. This will be linked to the suggestion above to work with local industrial sites to better understand their decarbonisation options and needs.

Since options for future use of hydrogen are also being developed and discussed at a national scale, it is important that the proposed combined authority also monitors central government action in this area and engages with BEIS to ensure that local needs and priorities are sufficiently considered in the national decision making process.

* For example see: https://gmgreencity.com/projects-and-campaigns/local-energy-market/

Business Model Innovation

Business Model Introduction

The implementation of these LAEPs, and the transition towards net zero, is going to require innovative ways to fund the deployment of technologies. This section of the report, provides some examples of business models that could be used within the Y&NY region. These examples will focus on:

- Solar and Storage
- Retrofit

Business models outline how resources can be organised to deliver value to users. The most effective business model for local decarbonisation strategies will be dependent on the characteristics of the local area as well as the low carbon interventions most suited to the place.

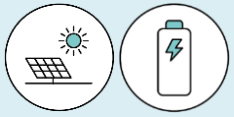
1 PLACE CHARACTERISTICS

- **Local Needs and Priorities** – How is energy used by locals currently and what problems do they face? Can additional value or pain points be solved at the same time as decarbonising the site or region?
- **Spatial** – What space restrictions are there, where can generation be located, how close is it to the demand that is being decarbonised?
- **Resources** - What resources are available to decarbonise (solar, wind, hydro, etc.)?
- **Density** – Are buildings in close proximity, how can generation be shared?
- **Energy Profile** – What does demand look like? i.e., time of day and intensity of energy use
- **Energy System** – What constraints are there for connecting new generation, or what constraints are there on existing demand?
- **Future Development Plans –** What does land and/or building use look like in the future based on development plans?

2 LOW CARBON SOLUTIONS

- Considers what the best technical solution is for decarbonising the site or region based on the place/site characteristics, for example:

SOLAR AND STORAGE



DOMESTIC RETROFIT

3 BUSINESS MODELS

- Business models should be considered in parallel with technical solutions.
- Based on what is best for the site/local area, the right balance needs to be made between what is technically possible (i.e., the technical solution) and how value can be maximised.

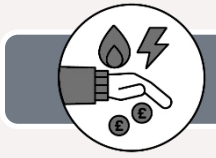
Stakeholder Roles

There are several key stakeholders in the Y&NY region. This slide provides an overview of the various roles that such stakeholders may have in the development and delivery of low-carbon business models.

EXAMPLE STAKEHOLDER ACTIVITIES ASSOCIATED WITH ROLE

INVESTOR

- Investing in and owning a generation, storage or local energy asset in the local area.
- Investing in a service company that acts as the delivery mechanism for the energy services provided to customers.
- Play a central role in the design of local energy markets and local energy platforms, that allows the community to trade different energy services.



CUSTOMER

- A stakeholder who buys energy from the energy system for its own buildings or operations. This includes power, heat and transport.
- Public buildings that benefit from the installation of energy efficiency improvements or low carbon technology.
- Leasing land to 3rd party to develop generation assets.

SUPPORTER

- Support project engagement by providing local community context and identifying key groups/routes to engaging with the community.
- Either provides data to allow others to undertake local area energy planning or undertakes themselves.

Solar & Storage – Business Model Overview

Name	Description	Financial	Co-Benefits	Delivery	Scalability
1. Power Purchasing Agreements and Sleeving	A commercial agreement between an energy generator and an energy user, for the sale of local renewable energy.	Fair	Fair	Good	Good
2. Solar and Storage Licensing	Solar and/or storage is installed at a site at no upfront charge, with power being sold on to the site by the owner of the energy assets.	Fair	Fair	Fair	Very Good
3. Local Energy Market	A software platform, or organization, that allows multiple generators and multiple local users to trade energy with each other.	Very Good	Good	Good	Difficult
4. Local Energy Tariff	A specific tariff that is only available in a local area, usually re-selling locally generated power to the community.	Good	Good	Difficult	Fair
5. Microgrid	A local network for dwellings and buildings that is directly connected to solar and storage. Is managed outside the standard distribution network.	Fair	Very Good	Mid	Difficult

Power Purchase Agreements & 'Sleeving'

A commercial agreement between the owner of a renewable energy asset (the generator) and an organisation with large energy demand (the off-taker). In a virtual PPA the generator will guarantee a price to the off-taker and any difference will be settled once they have been billed. This is viewed more as a financial transaction or hedge but will also include the transfer of Renewable Energy Certificated (REGOs). Alternatively, the generator and off-taker can use an energy supplier to act as a broker for their PPA, helping trade and settle the PPA agreement. Depending on the time and location of both organisations this can be more valuable then a standard virtual PPA.

KEY BENEFITS

Financial and CO_2

- Decrease in energy bills for off-taker, estimated at 20-30% based on 2021 prices,
- Minor uplift in revenue as a generator depending on PPA setup (c. 1-2p per kWh generated),
- Provides long term price security for generator and off-taker,
- Reduces carbon emissions - for off-taker through the purchase of REGOs.

Other Benefits

- Local skills and jobs if using local procurement,
- Easy to setup and well understood,
- Highly scalable if right sites can be found in local area..

RISKS AND CONSIDERATIONS

- Limited commercial viability for smaller scale projects and more complicated sites,
- Business case has some risk and is dependent on future energy price forecasting,
- Existing supply contracts may not include best value terms for sleeving, need to negotiate at the same time supply contract is up for renewal,
- Best pricing will be for projects, or aggregation of projects, above 5MW.

EXAMPLES

CITY OF LONDON

WARRINGTON Borough Council

BRISTOL CITY COUNCIL

Power Purchase Agreements & 'Sleeving'

Warrington Case Study

Overview of Project

- York and Hull solar farms are projects developed by Warrington Borough Council which integrate ground mounted solar PV with battery storage.
- The Public Works Loan Board was used to finance the two sites.
- There are two routes of revenue for Warrington:
  - Sleeved PPA directly with its own local authority demands,
  - Npower optimises operation of battery and provides a route to market,
  - 90% value of wholesale market and ancillary services and 100% of embedded benefits flows through to Warrington Borough Council.

Scale of Deployment

- Investment of £60m across the two sites,
- Hull is a 25.7MW_p solar farm that includes a 21MW battery,
- York is a 35MW solar farm with 27MW battery,
- Expected to return £210m over 30-year project lifetime.

https://www.local.gov.uk/case-studies/warrington-borough-council-commercial-approach-public-sector-clean-energy-investment

https://www.solarpowerportal.co.uk/news/gridserve_completes_game_changing_solar_plus_storage_site

Licensing

Where solar and storage is installed on a building at no up-front cost to the building owner. Often referred to as "solar for free" or "rent a roof" model which was pioneered in early 2010s when renewable subsidies were introduced. This business model is making a return, especially in social housing and community groups, where there is a desire to improve housing standards but issues around affordability.

In this model, the installation of solar and storage is covered under a "licensing arrangement", which means the assets are owned by a 3rd party. Any power used on site from the assets is covered under a PPA and should provide a reduction in energy bills for no upfront cost. The asset owner uses the value they generate to recover costs - any extra is kept as margin. Primarily aimed at cluster of dwellings (e.g., social housing) and can include further upgrades like low carbon heating or retrofit. The model is also applicable for any organisation with multiple sites depending on suitability.

KEY BENEFITS

Financial and CO_2

- Energy bill reduction - estimated 10-20% reduction in energy bills for no up-front investment,
- Fixed price PPA provides greater price certainty over 20-year period,
- Limited ongoing costs or risks compared to other bus model as assets maintained by 3rd party.

Other Benefits

- Helps finance roll out of solar and storage at scale and reduce need for public spending,
- Fair transition – allows low-cost access to net zero transition,
- Reduces complexity and effort of delivery in house by a local authority or community group.

RISKS AND CONSIDERATIONS

- Potential legal issues of roof licensing and 3rd party asset ownership,
- Complexity on energy supply contracts, especially with tenants,
- Only deployed in social housing currently
- LA loses control of future revenue opportunities,
- Cost of finance likely to be higher compared to what a local authority can raise.

EXAMPLES

SMS

Licensing

SMS Case Study

- Solopower is a turn-key solar PV and battery storage solution for social housing
- Assets are installed at no upfront cost to the tenant through a PPA contract between the provider and the landlord. Typical contract length is circa 15-20 years
- Flexigrid technology remotely controls the battery storage asset to optimise when it charges and when it dispatches and exports stored energy into the grid to generate revenue
- Trialled in Orkney as part of Re:Flex Orkney, an IUK demonstration project
- Social Housing Demonstrator in Aberdeen is a £5.2m pilot project which combines this solution with fabric retrofit and low carbon heating, again using controls developed with Flexigrid
- For over 100 social houses and the project aims to improve comfort levels and lower energy costs
- The installation phase of the scheme completed in Feb 2022 and has created 39 local jobs. Energy performance of dwellings currently being assessed.

https://www.sms-plc.com/about-us/case-studies/reflex-orkney/

https://www.sms-plc.com/insights/blogs-news/sms-partners-with-aberdeen-city-council-on-100-home-decarbonisation-retrofit-scheme/

Local Energy Market

The point of a local energy market (LEM) is to link multiple generators with multiple off-takers in a single pool. By aggregating everyone together there is the possibility of increasing the value for both parties. One version of a local energy market is a "Sleeving Pool" where a "Pool Manager" plays the central role in coordinating contracts and finding the best mix of local generation that matches demand. Generators can setup direct PPAs with off-takers or leave supply open to be traded in the pool.

The second version is a Local Energy Exchange which is facilitated by a digital platform. In both cases a central organisation is responsible for local balancing and intraday trades . The differences are in how the price is set for trades -with a local energy exchange being more an open market in theory.

LEMs also have the potential to offer a wider array of services as the market matures like different energy services.

KEY BENEFITS

Financial and CO_2

- Improves on a Sleeved PPA by:
  - creating economies of scale,
  - matching generation and demand,
  - reduced network charges and improved imbalance position,
  - further revenue if flexibility traded,
- Moves community to 100% renewable power that would meet Ofgem green tariff criteria.

Other Benefits

- Creates a stronger business case for local generation,
- Improves system resilience and flexibility,
- Retains value locally.

RISKS AND CONSIDERATIONS

- Value is dependent on market design and local price signals,
- Need enough scale, or liquidity, in the pool / market,
- Only a few trial projects and feasibility studies,
- A partner is required to be the Pool Manager or Local Energy Exchange,
- Risk that the Pool or LEM becomes more regulated and value opportunities are reduced.

EXAMPLES

regen transforming energy

together housing

UrbanChain

Bristol City Council

Local Energy Market

Urban Chain Case Study

Overview of Project

- Urban Chain is a Peer-2-Peer software platform that serves both local generators and local energy users to provide matched renewable power.
- There are different applications of the platform:
  - Local Peer-2-Peer where UrbanChain serves an entire local area with a mix of generators and end users,
  - Private Peer-2-Peer where it is a closed exchange serving only buildings and generation specified by the main investor
- Cost savings are derived from network efficiencies and the licence exempt cost avoidance.

Scale of Deployment

- Working with West Suffolk Council and an industrial park with 50 businesses participating in a local energy exchange and demand side management trial
- Businesses save £40-50 per MWh on bills and get an uplift of £30 per MWh of solar energy exported
- Also working with Together Housing Association
- Partnership will allow 500 houses and bungalows within Lancashire and Yorkshire to buy (and sell) green energy amongst themselves and others.

https://www.current-news.co.uk/blogs/p2p-trading-and-demand-management-at-industrial-parks-a-look-at-west-suffolks-project

https://www.current-news.co.uk/news/urbanchain-onboards-first-housing-association-as-it-continues-to-grow-p2p-market

Local Energy Tariffs

A specific tariff that is only available in a local area, usually re-selling locally generated power to the community. There are a few variations of local energy tariffs that exist today:

1. "Local generation tariff" – customers get a reduction in their bills when there is local generation online and generators get an uplift in their PPA price when they match to local demand (e.g. Octopus Fanclub, Energy Local)

2. "Local Investor tariff" – customers part invest in a generation asset and get a rebate or share in revenue (e.g. Ripple Energy)

Tariffs are currently aimed at domestic consumers and often delivered in partnership with local community energy groups. Feasible that wider community buildings or local authority buildings could be brought into the local tariff.

KEY BENEFITS

Financial and CO_2

- Decrease in energy bills for off-taker, but this is variable depending on local generation matching with local demand,
- Moves community to 100% renewable power that would meet Ofgem green tariff criteria.

Other Benefits

- Creates a stronger business case for local generation,
- Retains value locally,
- Community engaged in local decarbonisation,
- Minor system resilience improvements,
- Local skills and jobs.

RISKS AND CONSIDERATIONS

- Reliant on an energy supplier to do local matching - only one supplier in the market currently,
- Contractually complex to setup,
- Could be scaled over time and encourages diversity in investment in local renewables,
- Flexibility in location - examples (e.g. Ripple) do not require generation and demand to be closely located,
- Not yet tried with local authority.

EXAMPLES

Ripple

octopus energy

Energy Local
making energy work for you

Local Energy Tariffs

Energy Local

Overview of Project

- Energy Local are a Community Interest Company that help communities setup a local energy tariff
- Each community that wants to participate sets up a local co-op called an Energy Local Club
- The idea of the club is to get more value from when local generation is being used by creating a bespoke tariff for local dwellings and businesses
- The generators and households in the club agree a match tariff, which is the value that generators sell directly to the dwellings (in essence a PPA agreement)
- For any additional power demands a time-of-use tariff is available from Octopus Energy / Younity
- Households and businesses need to have a smart meter fitted to monitor when energy is being used and how well it "matches"
- For the club to stack up commercially there has to be sufficient match, otherwise dwellings could potentially pay extra

Scale of Deployment

- First club was setup in 2016 in Bethesda (North Wales) anchored around a 200kW hydro power plant
- Over 20 clubs have been setup or are in the process of being setup
- Membership can range from 20 to 100 dwellings - very dependent on size of generation in the club
- Looking at additional value that can be created, including demand response trials and other ways of trading flexibility

Tariff	Day rate	Peak rate	Night rate
Match tariff rate (p/kwh)	14.5	19.0	12.2
Grid rate (p/kWh)	18.5	28.3	12.3

Example tariff from Bridport Energy Club

Microgrid Models

A microgrid is a series of buildings that are connected to a local renewable energy asset like solar or storage. This network sits behind a grid supply point and would fall outside of the responsibility of a standard local network operator or DNO. Any renewable energy generated is used within the microgrid at a reduced price to standard power that would be imported from the grid. It is rare that the microgrid is totally self sufficient, or islanded, and some additional power will be required from the grid in the winter. It is up to the microgrid operator to balance the needs of those using it, the power being generated and how to source and surplus energy required.

Most common applications are in small scale new build developments, usually with low energy demand and high energy efficiency. There is also a "collective self consumption" model similar to a microgrid which is more common in high density residential developments.

KEY BENEFITS

Financial and CO_2

- Dependent on many factors like the size of generation and power demand of buildings
- Trials suggest c. 10% reduction in bills vs standard market price (2021 prices)
- Moving dwellings to net zero standard, so hugely beneficial if scalability can be improved

Other Benefits

- Creates high-quality, high-energy efficiency dwellings in the community
- Could involve some community ownership or investment in the microgrid or low carbon measures being installed
- Costs are not born by homeowner so makes net zero transition more accessible

RISKS AND CONSIDERATIONS

- Only being done in small scale trials currently (50-100 dwellings) so limited scale
- Complex to setup – will involve multiple partners and unique legal agreements not yet common place in the market

EXAMPLES

Electric Corby
Switched on thinking

Bristol Energy Cooperative

clean energy prospector

SMARTKLUB
Empowering Communities

Microgrid Models

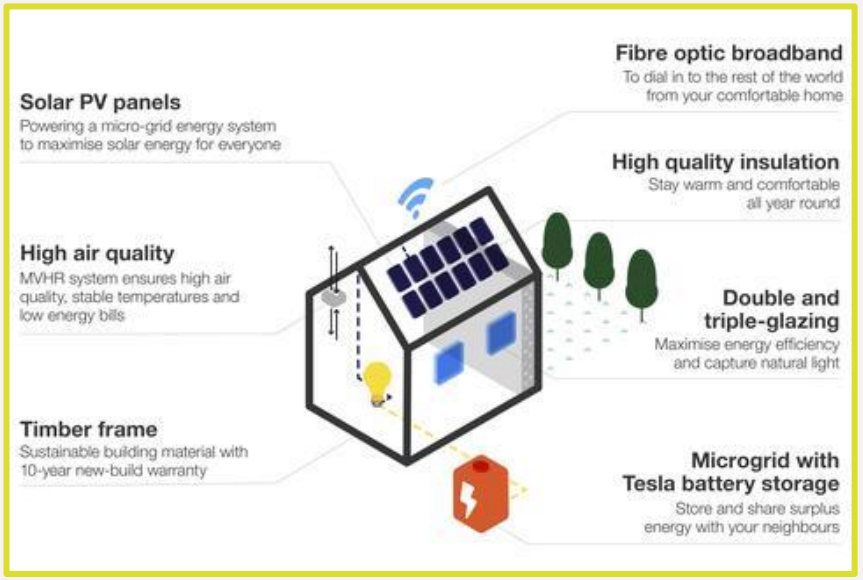
CEPRO and Bristol Energy Co-operative

Overview

- Partnership between Bright Green Futures (developer), Bristol Energy Co-op (energy assets), CEPRO (microgrid design)
- Managed through a community Energy Services Company called the Microgrid Foundry Bristol Energy Co-op is funding the battery and the microgrid infrastructure at the site through £2m community share offer
- Each dwelling fitted to high energy efficiency standard including installation of heat pump and thermal store
- One big power battery on site (Tesla) to manage any export and share at times of low solar generation
- All sat behind a single sub station which is managed by CEPRO to optimise any generation, demand and any additional revenue from trading or flexibility services
- Not a true microgrid, as some import will be required, but has been designed in a way to try and be self sufficient as possible

Scale of Deployment

- Water Lillies is a new build development in Bristol consisting of 33 dwellings
- Size of the microgrid is 115kW$_p$
- The second microgrid is with Bridport Cohousing using the same interconnected methods adopted at Water Lilies.
- BEC is funding the battery, PV and microgrid elements here
- Project is 54 dwellings and microgrid is 210kW$_p$



Other Considerations

Out of Area PPA (For Solar Farms)

Investing in, or purchasing, solar and storage assets throughout the UK on a virtual Power Purchasing Agreement. Where the local authority is buying direct this can be used as a financial hedge against existing energy bills. The model could be adapted to re-sell power to the community as well, akin to a Local Energy Tariff, but would need further investigation and there are regulatory barriers and commercial risks to local supply. Younity example of a national provider which could be explored.

Grid Connected Storage

Investing in stand alone battery storage assets projects around the 20-50MW scale. Examples where local authorities or community energy groups are involved, usually involve JVs or SPVs with other commercial partners who can provide technical expertise. The local area takes on responsibility for providing land, raising finance, navigating planning restrictions and the commercial strategy which seeks opportunities to generate income to future-proof council services to benefit their communities. It also helps the council achieve its commitment to reducing carbon emissions by 2030

Collective Self Consumption (Roof Mounted Solar / High Density Residential)

Model originated in Germany focused on medium and high density buildings (e.g. tower blocks). Involves generation assets supplying a building, usually under a private wire arrangement, and benefits being shared equitably amongst all tenants in the area. Has now been trialled throughout Europe. Emergent Energy's "Solar 4 Flats" most prominent offer in UK.

Retrofit – Business Model Overview

Name	Description	Financial	Co-Benefits	Delivery	Scalability
1. Optimised Retrofit	The goal of this business model is to gradually deliver low carbon improvements over time, with the use of better data and analytics that build a pathway to a net zero dwelling. Savings from cost effective measures are used to fund more expensive ones.	Some risk	Good	Fair	Good
2. Energy Performance Contract	The "Energiesprong" approach. Whole house retrofit is delivered in one go with an energy performance contract that guarantees energy savings and the long-term performance of those improvements.	Some risk	Good	Fair	Fair
3. Neighbourhood Approach	Providing access to funding and low carbon improvements on a neighborhood, or street by street basis. Funded through mix of public and private finance.	Some risk	Very good	Some risk	Some risk
4. Community Homes	Community energy groups leading on the design and operation of low carbon and affordable homes for the community.	Good	Good	Some risk	Difficult

Energy Service Contracting

This approach uses a combination of data, analytics and low carbon technology to help dwellings reach net zero. There are four key components to the approach:

1. Using connected devices in dwellings to build a realistic picture of how energy is being used
2. Analytics to build the cost optimal way of transitioning the dwelling to net zero
3. Creating an energy services plan that will replace the energy contract, and create energy efficiency packages that will be installed and funded through energy savings
4. Maximise the value of energy by utilizing time of use tariffs and trading any excess energy generated

There are numerous providers of steps 1 and 2, especially in the social housing market. Steps 3 and 4 are being developed by smaller scale innovators like Sero and SMS, but they are not being delivered at scale yet.

KEY BENEFITS

Financial and CO_2 reductions

- End users are expected to see some decrease in bills (c. 10% based on 2021 prices)
- Increased house value over time for property owners
- Transition dwellings to net zero / band A so very positive impact in terms of CO_2 reductions

Other Benefits

- Increased health benefits from healthier dwellings
- Local skills and jobs if recruiting local installers
- Improved dwellings can have significant intangible community benefits including better sense of place, stronger sense of community

RISKS AND CONSIDERATIONS

- Significant merchant risk to generate enough revenue through energy trading and flexibility services
- Risk on energy savings, have to be confident savings will be realized to pay for low carbon measures in the future
- Contract lengths have to be long, with a minimum of five years and maximum of twenty
- Shortage of suitably trained workforce could impact delivery

EXAMPLES

sero

SMS

Energy Service Contracting

Sero Optimised Retrofit

Overview of Project

- Sero are a home developer and software company based in Wales
- Their main project is optimised retrofit which is being rolled out across Wales with 26 social housing partners
- The aim is to provide a better quality and more cost-efficient way of improving the energy performance of dwellings
- That's firstly addressed through the Whole Home Survey app, which allows better quality surveys and data to build a detailed picture of the current energy performance of the dwellings
- A second digital tool, Pathways to Zero, will identify a phased approach to reducing the carbon footprint of the property to the lowest possible level
- That optimized plan can then be self funded by the property owner
- Or in the future be funded through Sero Life, that will provide digital controls and an energy service plan that will fund the improvements through energy savings

Scale of Deployment

- The collaboration of 68 partners, including 26 social housing providers, and managed by Sero, will see the decarbonisation of more than 1,750 Pathfinder dwellings
- The project has received £13m funding through the Welsh Government's Optimised Retrofit Programme, part of the Innovative Housing Programme
- Sero Life is being explored as part of an ERDF funded project in Swansea

Energy Performance Contracting

Very similar to the optimised retrofit model, with two key differences:

1. There is a strong focus on ensuring the energy savings or energy performance of any low carbon / energy efficiency measures installed
2. The measures being installed are usually done in one go, classified as the "whole house approach".

The main contractor will provide an energy performance contract with the dwelling at a fixed price per year. Energy savings are in effect guaranteed in this plan, and are used to help pay for the retrofit over a 25-30 year period. If energy savings are not realised then the installer loses out. This plan is separate to the dwelling's energy bill which will still be paid as normal.
The most prominent example of this model is Energiesprong which is covered in the case study. This model also includes a pre fabricated insulation technology that speeds up the whole house retrofit process, but the model could still be adopted without being tied to the technology.

KEY BENEFITS

Financial and CO_2

- Due to cost there are likely to be minimal savings for the dwelling (<10%)
- CO_2 savings per dwelling incredibly high with some trials delivering a net zero standard

Other Benefits

- Better quality, healthier dwellings which can massively reduce impact of cold related illnesses
- Improve house value and land value in the area
- Wider social impacts and costs due to better quality dwellings and better pride of place
- Opportunity for local jobs and upskilling local workforce

RISKS AND CONSIDERATIONS

- Very expensive and low returns for investors – c. £50k per dwelling depending on the final standard targeted
- Supply chain is immature and it can be difficult to source a main contractor to co-ordinate
- Installers are wary of long term guarantees and performance contracting due to risks
- Less reliance on energy suppliers or interfacing with energy markets, which makes it more suitable for local / community projects

EXAMPLES

energiesprong uk

refit

EQUANS

Energy Performance Contracting

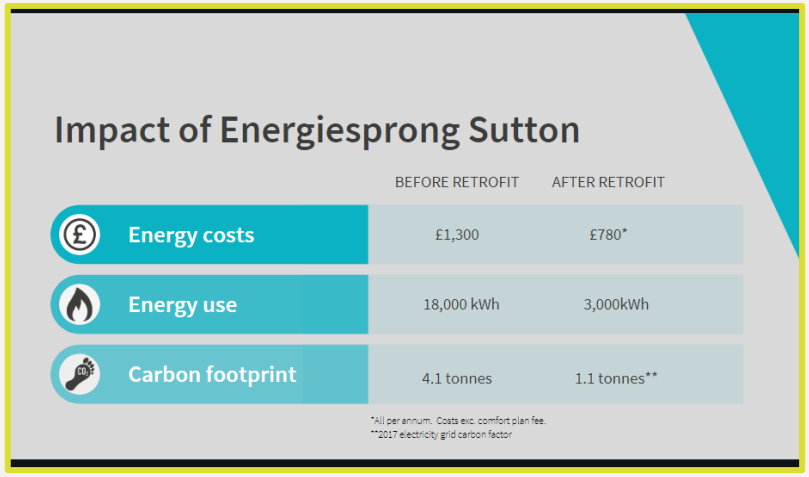
Energiesprong

Overview of Solution

- A whole house retrofit "system" that combines innovation in energy efficiency, innovation in procurement and energy service contracting
- Central to it is a pre-fabricated external cladding system that will provide high energy efficiency walls, windows and doors
- Upgrades will also include upgrades to the roof, solar and low carbon heating
- The whole process is completed in a maximum of 15 days to minimise disruption to the end user
- Total cost is estimated at £65k per property, but they are hoping to reduce this to £50k in the next few years
- Energiesprong System Provider has to guarantee the work for 30 years
- Residents receive guaranteed minimum levels of comfort and continue paying for heat, hot water and light at the rate prior to the work being done
- The difference between this and the reduced cost of energy to run the dwelling pays off the loan for the extra over cost

Scale of Deployment

- Energiesprong UK and Turner & Townsend set up the Innovation Partnership, a SPV to deliver the retrofits
- The Innovation Partnership has eight social landlord partners which include six London boroughs, Nottingham City Homes and Sanctuary Homes in the South-west
- The GLA established the Retrofit Accelerator for Homes which has the objective of achieving 1,500 deep retrofits in London
- Keepmoat / Equans offering Energiesprong type deal across UK



Neighbourhood Approach

Creating an investment vehicle that will help finance, contract and deliver retrofit within a local area. This would be a "planned approach" to retrofit, rather than market led, with a key focus on economies of scale and improving the cost to serve. A few models exist:

- Local grant funding, subsidies or tax breaks which are made accessible to the local area for low carbon projects (e.g. Hackney Borough Council, BHESCo in Brighton)
- Private / public partnership to regenerate an area (e.g. Rugeley and Equans)
- Local authority or city led approach (e.g. West Midlands Combined Authority, Bankers without Boundaries)

In all cases the key benefit is community engagement. By creating a single, community led approach, there should be greater confidence and higher participation from dwellings and businesses.

KEY BENEFITS

Financial and CO_2

- Requires a mix of private and public spending so financial returns are low, steady and long term
- Delivers net zero dwellings, so huge impact and potentially scale if take up is higher than other approaches

Other Benefits

- As per other retrofit projects in terms of improved health, wellbeing and social returns
- Often coupled with wider regeneration aims like improved transport, clean air and green spaces
- Likely to deliver best community engagement in net zero

RISKS AND CONSIDERATIONS

- Finding the funding – in many cases local areas have just repurposed LAD funding for a specific area
- Very early-stage concept – most activity has required innovation or grant funding as a starting point
- Steady but long returns will only suit certain type of investors
- Needs to be done at scale to raise the finance, best suited to densely populated areas

EXAMPLES

West Midlands Combined Authority

EQUANS

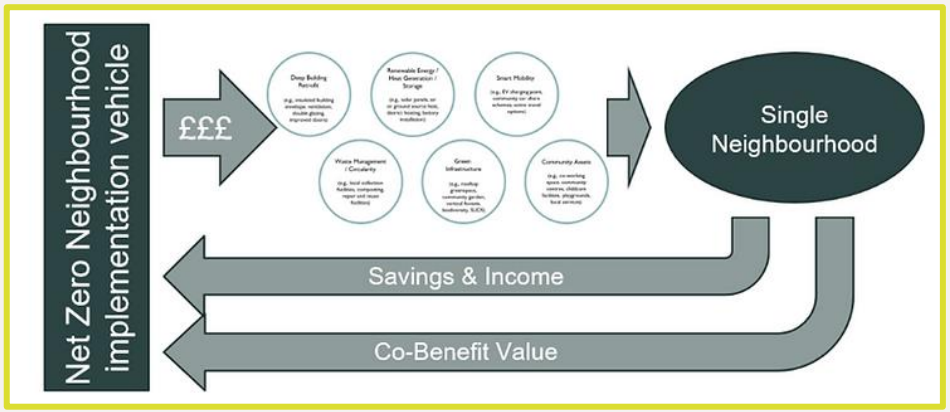
BHESCo

Neighbourhood Approach

West Midlands Combined Authority (WMCA)

Overview of Project

- A £2m demonstration project launched by WMCA in 2019.
- Aims to demonstrate how retrofit could be designed and delivered on a street-by-street basis.
- While sharing resources on community engagement, delivery and financing across a region.
- As part of the initial trial looking to identify 3-7 neighbourhoods in a district with each neighbourhood designing their own net zero plan.
- WMCA investment will be used to fund retrofit, low carbon heating measures and other low carbon infrastructure.
- Planning to create a replicable financial model to deliver a pipeline of neighbourhoods with increasingly less reliance on grant funding.
- This is being done in collaboration with Energy Capital and Bankers without Boundaries, taking on ideas from "Financing Net Zero Neighborhoods" white paper.



Scale of Deployment

- Part of WMCA's five year plan is to retrofit 300k dwellings by 2026.
- Selection process for net zero neighbourhoods is taking place by the end of 2022, delivery starts 2023.
- The plan is to create a pipeline of projects across 5 Birmingham districts, with new neighbourhoods continuing to submit their net zero plans to aid in discussions with investors.
- WMCA also looking at wider opportunities for local flexibility markets and regional system operation that will allow the area to have greater control over how its climate strategy can be delivered.

Community Homes

Community Homes is where the local community take a greater lead in designing and investing in low carbon dwellings. A new legal entity is created (e.g. a Community Interest Company) that will take full end to end responsibility of house building – from finance to design to build and any ongoing support. The business model is built on the logic that a community is willing to invest in net zero, affordable homes for the area, rather than relying on private investment which will be more focused on making a return on the properties.

Making a return on investment will be difficult without further innovation, as they are trying to keep rent and house prices affordable. Both PEC Homes and Bristol Co-op are developing energy service contracts for the homeowners, so that energy bill savings can be used to repay the extra low carbon improvements.

KEY BENEFITS

Financial and CO_2

- Assumed to be similar to the Microgrid or Performance Contract model, as some form of energy service contract is required to repay finance
- Delivers a net zero dwelling at an affordable price, so hugely beneficial to climate targets if it can be done at scale.

Other Benefits

- Provides greater access to net zero for those who can't afford it
- Will address high cost of living, especially around future energy bills
- Investment and returns retained locally
- Can encourage local jobs and upskilling

RISKS AND CONSIDERATIONS

- Community share offers or community bonds have not exceeded £1m which makes concept difficult to scale
- Long lead times on development are very long term so will take time to mobilise
- Hugely competitive market in terms of land availability and planning
- Requires upskilling community energy groups so that they have sufficient building and energy supply experience

EXAMPLES

PEC HOMES

Hook Norton Low Carbon
Supporting Sustainable Living

Bristol Energy Cooperative

Community Homes

PEC Homes

Overview of Project

- PEC Homes as an independent Community Benefit Society and Community Land Trust setup in 2020
- Have received preliminary planning approval for an affordable, community led, zero carbon development of 70 new dwellings in Plymouth.
- The key goals for the development are:
    1. Up to 100% affordable housing, rather than 55%.
    2. A target of 100% net zero carbon, rather than 55%.
    3. Creating more focal community green spaces, with improved access to surrounding local nature reserves.
    4. Deliver a net gain in biodiversity and provide opportunities for local food growing.
    5. Further promotion of sustainable transport options, including potential for wider community access to electric cars and bikes.
- It will be the first new build development to adopt the Energiesprong approach in terms of technology and contractually, with performance guarantees embedded in contracts.
- Want to retain community ownership, and community share offer to be launched by the end of 2022.

Scale of Deployment

- Building planned in two phases, with first phase due to start in 2023.
- Being developed in partnership with Plymouth Council as part of their £15.4m Plan for Homes, five thousand new dwellings will be built in Plymouth over the next five years.

Heating – Business Models

Shared Ground Source Heat Pumps

A more contained version of a heat network, where a shared ground loop / bore hole can be used to serve multiple dwellings within an estate. By sharing the cost of any external work it should improve the business case for installation. Some initial trials for social housing and new build developments. Increased running costs compared to gas boilers not addressed in business model.

Renewable Powered Heat Networks

A central heat pump in a plant room is used to serve a heat network. That heat network is served by a private wire from nearby solar and storage assets. The logic of the business model is that the energy assets can support demand side response and flexibility services that increase the cost effectiveness of the heat network

Heat as a Service

Moving away from selling kWh and selling customers an outcome based service like a warm dwelling or comfort. This has two benefits: 1) it focuses on delivering a service that customers value and possibly pay more for and 2) if the focus is on outcome the service provider can help manage the transition to low carbon heating

Warmth on Prescription

Similar to heat as a service, but with a specific focus on addressing fuel poverty and vulnerable customers. Involves collaboration with the NHS to identify those suffering from cold related illness symptoms. A service provider, collaborating with NHS, can prescribe a warm dwelling and monitor and subsidise what a comfortable level of heating should be.

Transport – Business Models

Solar Car Ports
Where space is limited, public car parking or public sector sites can have solar mounted on top. Usually connected to nearby site through private wire arrangement. Projects can also combine storage and EV charging to increase accessibility of low carbon transport.

EV Charging Hub
An EV charging hub that is powered by solar and storage. Involves a large concentration of EV charging infrastructure (c. 20 chargers) that can be used by a mix of public sector fleet vehicles or general public use. Solar and storage can be integrated to increase revenue opportunities.

Community Car Club
A community car club is a local, member-based initiative that provides access to self-service, pay as you drive, low-carbon vehicles. Often community car clubs are run by local groups to support their communities. Most interesting opportunities are when this service is combined with energy assets like EV charging infrastructure or storage.

Mobility as a Service Platform
A single platform or application that allows the local community to access a wide range of transport options. Offers an enhanced user experience by simplifying the way to access and pay for different modes of transport. Can also be used to incentivise lower carbon forms of transport.

Risks

Risks

There are risks and benefits associated with each of the technologies and options presented in these LAEPs. Due to these, the Y&NY region's actual transition is expected to vary from how it has been presented to reflect challenges and opportunities that have not been accounted for, or those that could arise in coming years. Therefore, before making any widescale and significant commitment to one option or technology over another, evaluation of multiple factors will be needed.

The key risks associated with these LAEPs are summarised below. Consideration of these aspects during implementation must be reflected, as outcomes may necessitate an update to these LAEPs. In addition, there may be additional market, policy and regulatory changes that could also result in a need to reconsider aspects of the pathway and LAEPs. Many of the actions identified in the Next Steps section of this document should also assist in mitigating some of these risks.

Risk	Description	Mitigation
Domestic and non-domestic heat decarbonisation using hydrogen	The LAEPs are based on projected figures for hydrogen availability, carbon content and cost; these have influenced the heat pump and heat network focus in a number of zones and are unlikely to accurately reflect future outcomes.	Concentration of early action in focus zones of least regret identified for heat pumps and district heating; moving forward, consideration of UK heat strategy and gas network plans will be needed before planning wider scale-up.
Domestic heat decarbonisation and resident acceptance	Transitioning away from fossil gas boilers to heat pumps or district heating will require innovative solutions to overcome resident acceptance of solutions that are more expensive to purchase and potentially disruptive.	Focusing implementation in off gas grid areas reduces risk associated with picking a technology type, where heat pumps would be a low regret solution. These areas could be used to test models and approaches that appeal to residents before considering wide scale up. Building on previous local projects such as North Yorkshire's Warm Homes to design new schemes that incorporate previous learning.
Level of district heating	The rationale of transitioning large numbers of dwellings to district heating is based on the ability to cost effectively provide district heating systems in comparison to other options. These LAEPs have only been able to consider the effectiveness of the proposed district heating areas at a high level, more detailed consideration will be needed.	Focussing on areas which have a high-density of buildings increases the likelihood that a district heat network will be cost-effective - more detailed studies are needed to confirm which zones have the highest potential. Heat networks could be lower risk than individual heat pumps for low income residents as the cost is less likely to fluctuate and the emissions, due to the technology choice, can be managed centrally and these aspects should also be taken into consideration in studies.

Risk	Description	Mitigation
Level of local generation (solar PV)	The significant level of solar PV proposed is primarily related to the requirement to cost effectively reduce carbon emissions ahead of the decarbonisation of grid supplied electricity and is most effective at reducing carbon in the earlier years of the plan. However, it presents many challenges related to the scale and speed of role out required.	Further consideration of the benefits to the Y&NY region, potential operating models, system design (e.g. considering smart local energy systems), land use and whether large volumes of locally generated renewable energy can and should be exported to the grid.
Non-domestic buildings and suitable solutions	The decarbonisation options that have been assessed are based on high level information regarding the buildings, their energy systems and the operation/processes of the site. More detailed information will be required to refine preferred solutions.	Identify an approach to better understand non-domestic building use, construction, heating systems and energy use and preferred decarbonisation solutions, potentially targeting areas where a high proportion of industrial site types have been identified; this could also inform consideration of hydrogen to this area.
Practicality and disruption associated with heat decarbonisation	Both heat networks and heat pumps can work in most of the building types in York and North Yorkshire although heat networks will only be an option in urban areas. However, replacing gas based boilers with these options presents challenges; for example, installation costs and the potential disruptive internal works associated with adapting/changing the heating distribution system.	Focusing initially on off gas grid areas for heat pumps and areas identified as least regret for heat networks; aligning with the associated hydrogen based risk. In addition, consider any wider roll out once UK heat strategy is in place. Building on lessons learnt in previous local schemes such as Scarborough and Ryedale's Heat Pump Programme.
Social and community benefits and impacts	Each heat decarbonisation option results in varying benefits and impacts; for example, heat pumps could result in lower energy bills than a hydrogen or heat network system but the installation cost would likely be notably greater without policy intervention.	Use socio-demographic indicators when considering implementation; alongside targeting where corresponding whole home based solutions, such as providing deeper retrofit and domestic solar PV systems can best support those residents in most need.
Funding and investment	The LAEP has identified some possible funding sources but these will only cover a proportion of the total funding required.	York and North Yorkshire will need to work with regional partners and central government to identify potential additional funding routes as well as learning from previous applications for funding to schemes such as National Grid's Warm Homes Fund and the UK Community Renewal Fund to ensure good quality applications for existing schemes.

Risk	Description	Mitigation
Ability to rapidly scale and implement measures; considering supply chain and impacts of implementation rates	The ability to achieve a net zero target ahead of the UK's 2050 target will require the scale up and deployment of measures far beyond current or historical rates; in addition, the benefit of measures (e.g. solar PV) also depends on the ability to install extremely quickly and at highly ambitious scales.	Consideration of the corresponding projections for implementation will be needed to determine if and how ambition can be met.
Electricity Network Capacity	Significant increases to local electricity demand through increased use of heat pumps and EV charging and increased local renewable electricity generation could both be impacted by local electricity network capacity	Regular discussion and engagement with Northern Powergrid to ensure they have as much time as possible to prepare and implement any network changes required. Ensuring that consideration is given to development of Smart Local Energy Systems and associated local energy markets when developing schemes to reduce the influence of network constraints where possible.
Skills availability	The level of change required across York and North Yorkshire to meet the ambition demonstrated in the LAEPs will require significant local delivery capacity which may not be currently available.	Improving understand of local delivery capacity, identification of skills gaps and provision of local training to fill them
Gas Network affordability and availability	As consumers are switched away from the gas network the costs for remaining users will rise. In addition, maintaining the gas network to supply sites (e.g. industrial) in areas that are expected to be heat pump or district heat prevalent may prove problematic if areas of the network start to be decommissioned.	Care must be taken to ensure that increasing gas network costs do not end up being paid by those least able to pay by ensuring these households are given affordable options to switch alongside more affluent ones. Regular discussion and engagement with Northern Gas Networks to ensure that they have as much time as possible to prepare and implement any network changes required and that their plans for introduction of hydrogen into local networks are understood and accounted for during planning.
Coordination	There are a large number of stakeholders (both inside and outside the local area) that will be involved in, and influenced by the transition of York and North Yorkshire to Net Zero. There is a risk that lack of coordination may result in transition being blocked, assets being stranded or costs increasing significantly.	Identification of key stakeholders with regular discussion and engagement, creation of a LAEP Delivery Group and working with neighbouring areas as well as national government to ensure a common understanding and good coordination.

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If there are any questions about the method or outputs in this LAEP, then please feel free to contact the Energy Systems Catapult team on:

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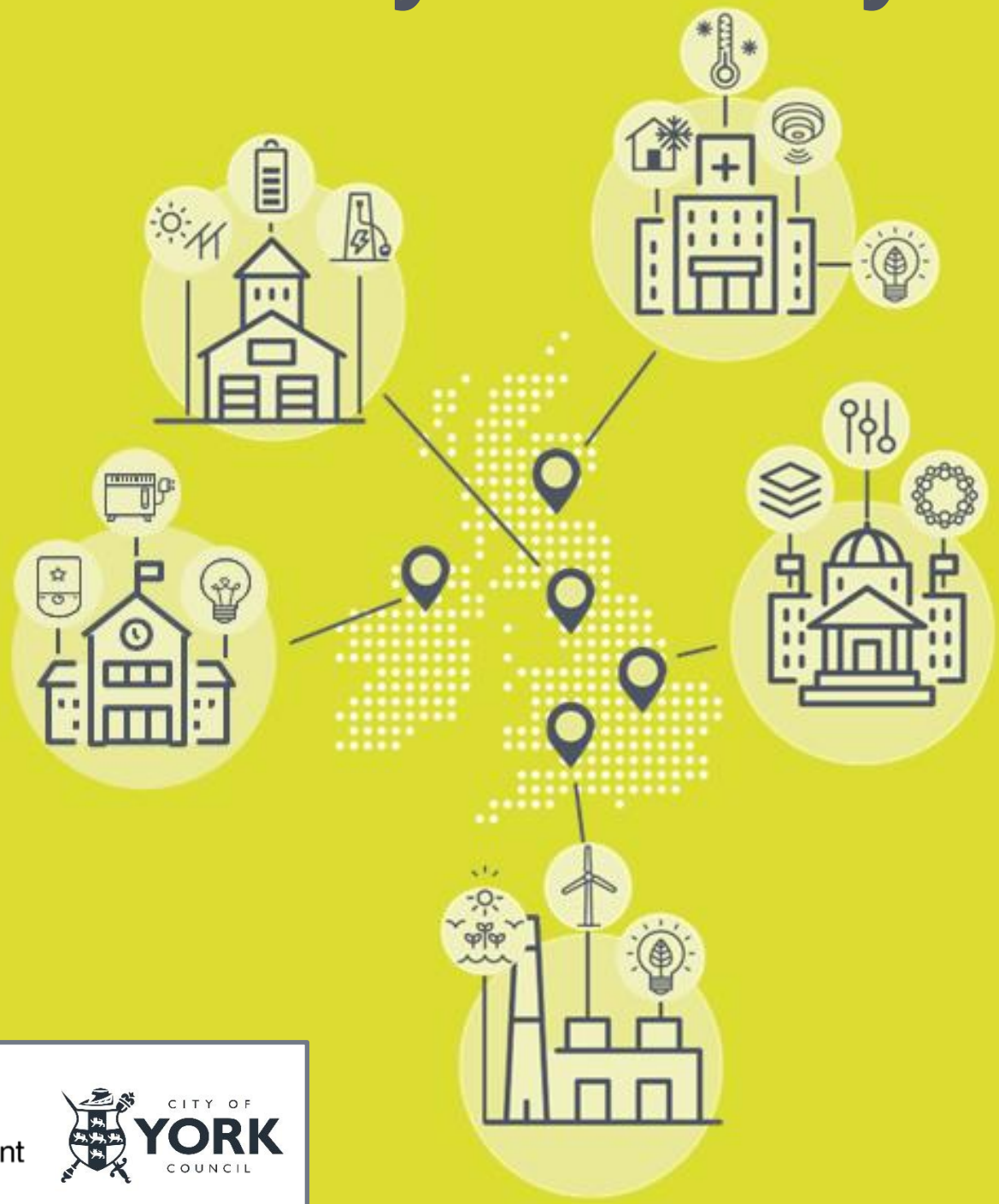
Annexe A – Stokesley Case Study

CATAPULT Energy Systems



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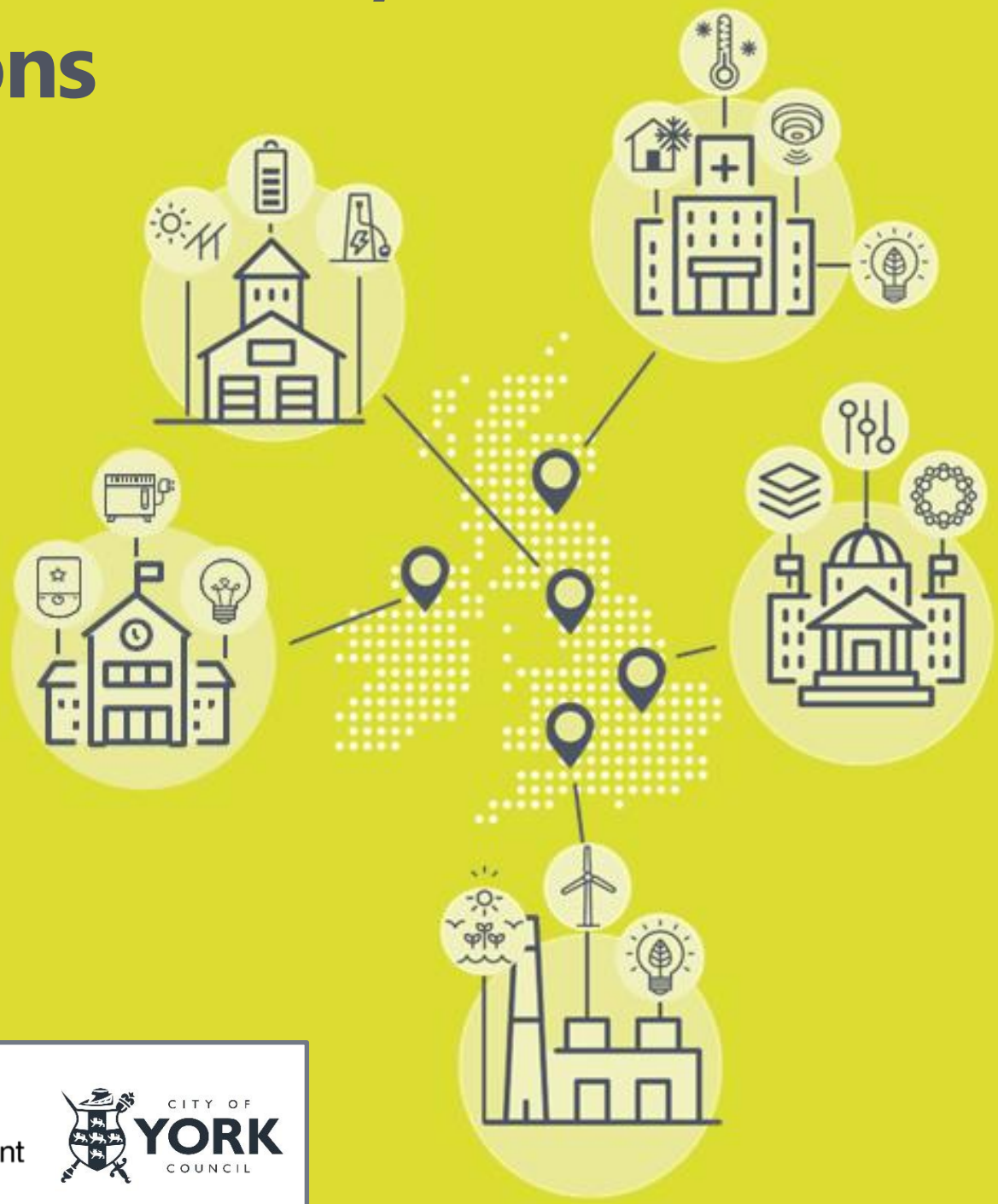
Annexe B – Method, Data & Assumptions

CATAPULT Energy Systems



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Annexe C – 2030 York

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