ZERO CARBON RUGELEY SLES
A RETROFIT ROADMAP – EXECUTIVE SUMMARY

April 2023

EXECUTIVE SUMMARY

Introduction

Zero Carbon Rugeley (ZCR) is one of 14 Smart Local Energy System (SLES) research projects funded by the government through Innovate UK as part of a Prospering From the Energy Revolution challenge.[1] This aimed to investigate investable, scalable local business models using integrated approaches to deliver cleaner, cheaper energy services in more prosperous and resilient communities that also serve to benefit the energy system as a whole.

Zero Carbon Rugeley has delivered a detailed energy system design for the Rugeley area which is sustainable, low carbon, and helps to drive the regeneration of the town and local energy infrastructure while offering additional services and value to residents and business. The project has put the involvement of the local community at its heart, working actively and creatively with local groups to identify what those living and working in Rugeley want from a future energy system. It responds to the town's rich energy heritage and was intended to respond to the ambitious low carbon plans for redevelopment of the site of a coal power station which closed in 2016 by creating an equally ambitious low carbon plan for the existing town through research into a SLES.

The ZCR SLES project looked at a number of elements to build a detailed understanding of their interdependencies and the integration of solutions to form the SLES model. SHAP took the lead on domestic buildings.
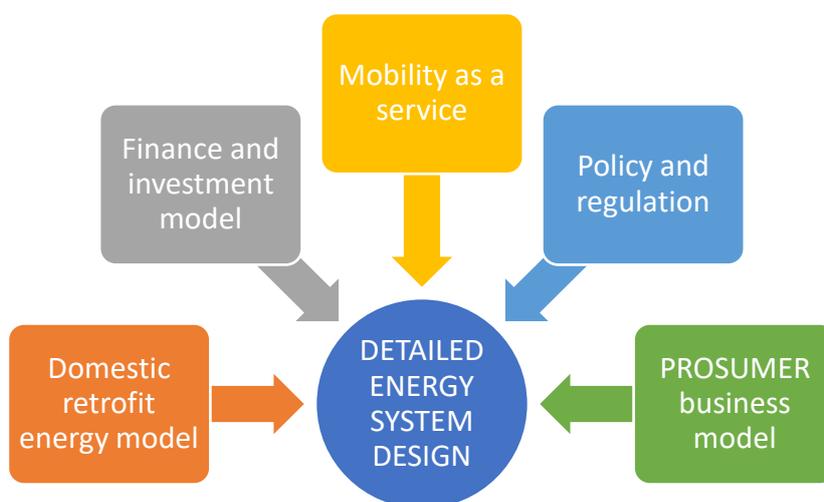

Figure 1 – The role of retrofit within a SLES system

The SHAP research resulted in confirmation of the need for retrofit system change, not as a discrete activity but within the wider context of a place-based approach to decarbonisation. The dependencies of a place-based decarbonisation approach requires that demand reduction of energy used in buildings is balanced against the existing grid capacity together

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[1] https://www.ukri.org/what-we-offer/browse-our-areas-of-investment-and-support/prospering-from-the-energy-revolution/

with proposals for new energy generation and storage, and forecast future demand due to electrification of mobility.

The key SHAP deliverable within ZCR was to create a retrofit roadmap for Rugeley. The headline learning was that there are multiple systemic and market failures in retrofit. These are well reported and have persisted over many years. System change is therefore essential in order to realise the objective of scaling up retrofit. A number of building blocks/component need to be developed in parallel and collaboratively to deliver the system change needed.

The Zero Carbon Rugeley retrofit roadmap

The Rugeley retrofit roadmap sets out a process for the creation of a robust approach to scaling up retrofit for 10,500 homes in Rugeley, that can be replicated and scaled up across the Cannock Chase District Council area and more widely. The roadmap focusses in detail on data collection, analysis and modelling but touches on other building block/components that need to be developed in order to create a new approach to scaling up retrofit. Some actions can be taken forward by residents, businesses and the Council, while many are dependent on activity by others locally, regionally and nationally. All require resourcing and the Rugeley retrofit roadmap sets out a list of next steps in the creation of a retrofit strategy and programme to create the necessary conditions for success in realising an all tenure retrofit programme for Rugeley.

It should be noted that current stock/area level modelling and architype-led approaches tend to be high level. This is important for strategic planning and provides guidance information for starting to plan for delivery of building-by-building retrofit. However, every property is different due to how it has been adapted over years and this needs to be considered when moving to specification and delivery of measures.

The SHAP retrofit roadmap therefore started with high level modelling but has iterated through several more detailed models to end up with a data set that is calibrated against actual energy use at a property level to provide three investment scenarios balanced against the current capacity of the electric grid at a local substation level. Experience shows that it is not enough to design and fund renewable energy projects such as PV installations if the local substation cannot accept the additional incoming energy generation, or energy demand through transitioning to electric heating or electrification of mobility.

A deep retrofit (reducing energy demand to a point where a property can become a net zero emitter of carbon emissions) is expensive for individual properties and so costs for a plan for a town will be extremely expensive. As a result, there is a danger that short-term, lower-cost improvements are developed for properties that create some improvements but can create larger retrofit needs in the future. For example, a gas boiler upgrade or new double glazing will improve the current efficiency of a poor energy efficient property, but it will mean expenditure on measures that will have to be removed and changed for later necessary upgrades. SHAP has designed its retrofit plans to ensure that these 'no regrets' costs are

included. A plan, held as a 'building passport'[2], can be developed providing a pathway to net zero with all phased improvements documented as an alternative to a very expensive 'deep' refurbishment expected to be delivered in one step.

The ZCR retrofit roadmap needs to leave Rugeley with the most effective retrofit improvements that are needed on a property-by-property basis, responding to individual property characteristics, while being delivered at scale.

Modelled retrofit scenarios

Recognising that there will be different investment potential and drivers for retrofit for each individual or group of properties, we chose three scenarios for the detailed modelling, all on a pathway to net zero and delivering the UK 2050 climate emissions reduction target:

1. Energy Performance Certificate rating of C (currently a target for rental properties for first let after 2030) but allowing for further retrofit at a later stage.
2. A deep retrofit with a target of 55 $kWh/m^2/yr$ with potential for further reduction in greenhouse gas emissions. This is close to the LETI standard[3] of 50kWh/m2/yr but reflects Rugeley stock and constraints.
3. A deeper net zero retrofit of 30 $kWh/m^2/yr$. This is close to the Passivhaus EnerPHit retrofit standard of 25kWh/m^2/yr but reflects Rugeley stock and constraints.

Key learning 1 – retrofit modelling outcomes

The models have shown that:

- Payback on investment recouped by energy bill savings for all scenarios averages 16 years with a range of 12 to 21 years depending on price and retrofit cost scenarios.
- Payback is quicker with variable tariffs compared to non-variable tariffs by between 1 to 3 years quicker. The deep scenario is 1-3 years quicker while the deeper scenario is 1-2 years quicker.
- The EPC C scenario has been modelled to ensure that interim improvements can be installed that do not significantly compromise further work later to get to net zero.
- The standing charge makes up a considerable proportion of the overall energy bill in the deep and deeper scenarios of between 40 and 45% respectively (averaged across the 190 houses).

Key learning 2 – addressing systemic failure through retrofit system change

Whilst the technology is already available and future energy scenarios are available, general experience and that of delivering BEIS-funded energy efficiency improvement projects over the last two years (evidenced by engagement with the national retrofit stakeholders group) confirms that a range of issues including lack of reliable data, reluctance of residents to engage, lack of supply chain capacity, costing for risk in innovation projects and other contextual changes and challenges often results in retrofit projects underachieving significantly or costing considerably more than planned. Most recently, the government's

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[2] Note that the concept of a 'building passport' recording every change to a building from a detailed baseline created by in depth survey is widely discussed but there is no template for this yet.
[3] https://www.leti.uk/retrofit

Social Housing Decarbonisation Fund (SHDF) Wave 1 has been extended as only 7% of 20,000 measures have been installed.[4]

Delivering a roadmap that can effectively be delivered requires more than modelled property improvement, no matter how detailed these are. SHAP's team of associates stress the need for a systems perspective when considering the scaling up of retrofit and energy systems. These are complex and require diverse stakeholders to work together on factors that do not immediately seem connected but need to be considered collectively to enable scaling of retrofit activities. SHAP used the Cynefin framework to illuminate the retrofit system which is particularly relevant to the development of retrofit within a SLES as it offers decision-makers a 'sense of place'. While technical solutions exist to improve properties (which the energy modelling activities demonstrated), successful retrofit programme will need to consider the many non-technical barriers and enablers that exist and act as a catalyst to the scaling up of retrofit. The role of residents to support, communicate and benefit from retrofit is critical but also complicated and requires resources and experts.

These issues collectively show the challenge for SHAP when developing a retrofit roadmap for Rugeley:

- The need for the roadmap to understand issues relevant to designing and delivering retrofit within Rugeley alongside broader issues that affect retrofit at a regional and national level, such as skills, training and regulations.
- The need to develop detailed, accurate retrofit plans at an area level before resourcing individual property surveys.
- The need to create a roadmap that can be flexible in its implementation but still achieve a longer-term objective of achieving net zero properties.
- The ability to create a local plan that can be delivered alongside national factors – including positive enablers and negative barriers.
- Despite these challenges and with a retrofit infrastructure that is largely unfunded, to create a legacy of awareness, skills and next steps that prepare Rugeley for large-scale retrofit works.

Finally, the roadmap has created some legacy resources that help the preparation of future retrofit delivery, along with the energy modelling and broader retrofit systems perspective.

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[4] https://www.insidehousing.co.uk/news/deadlines-extended-on-governments-social-housing-decarbonisation-fund-with-just-7-of-jobs-complete-80262