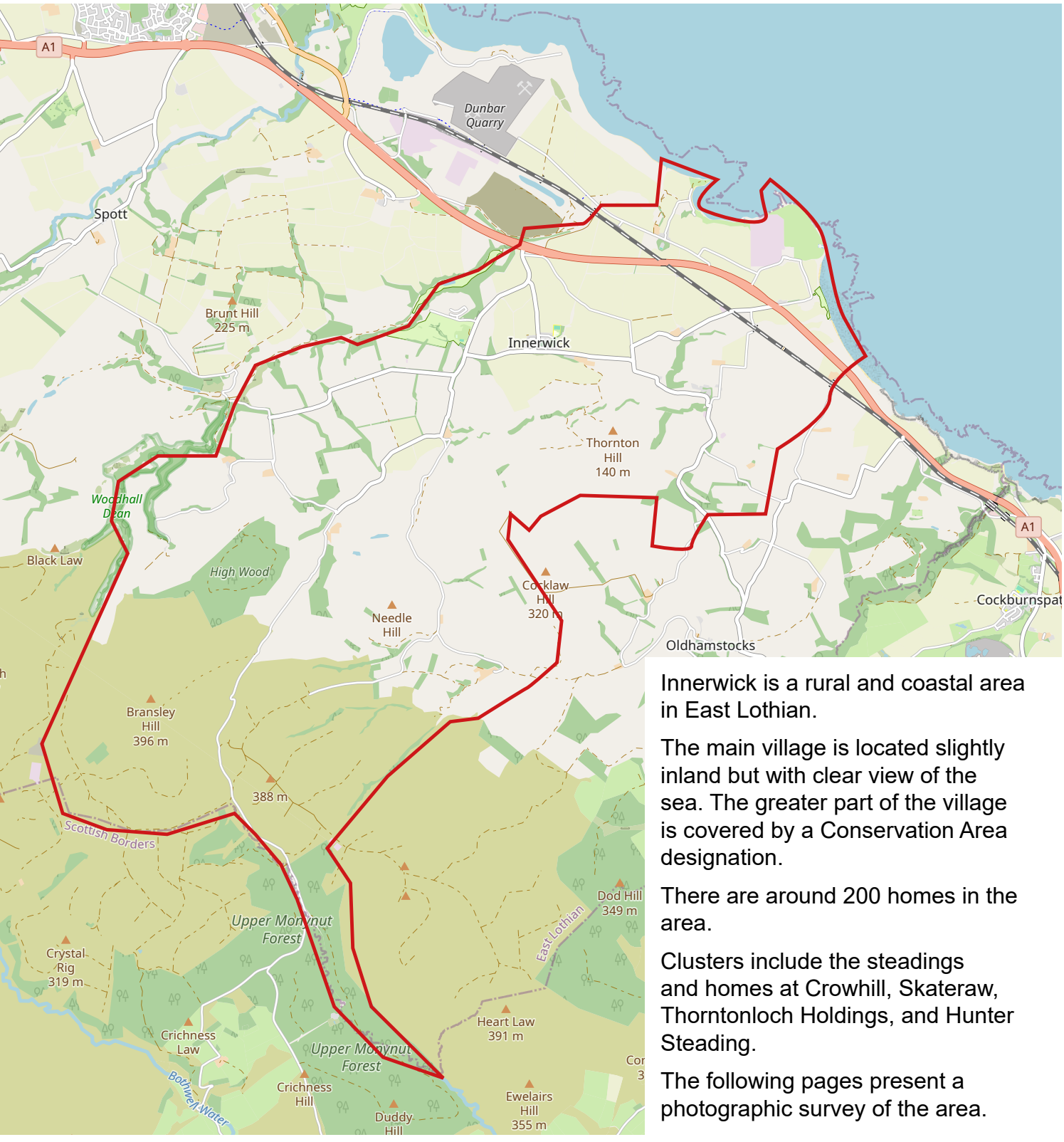
Technical Report

The Innerwick Area



Innerwick is a rural and coastal area in East Lothian.

The main village is located slightly inland but with clear view of the sea. The greater part of the village is covered by a Conservation Area designation.

There are around 200 homes in the area.

Clusters include the steadings and homes at Crowhill, Skateraw, Thorntonloch Holdings, and Hunter Steading.

The following pages present a photographic survey of the area.

OpenStreetMap with Polling District boundary overlaid

Key Learnings;

GIS map data is available from Council websites https://spatialdata.gov.scot and https://opendata.scot/datasets/

GIS info can be read for free on QGIS software

Technical Report

The Innerwick Area

Innerwick Village

The main settlement within the Innerwick area is the village, which has c. 90 dwellings.

Tenure throughout the area includes owner occupied, social housing (both Council and Housing Association) and privately rented homes. The village has the only social housing in the area, and has a socially mixed population.

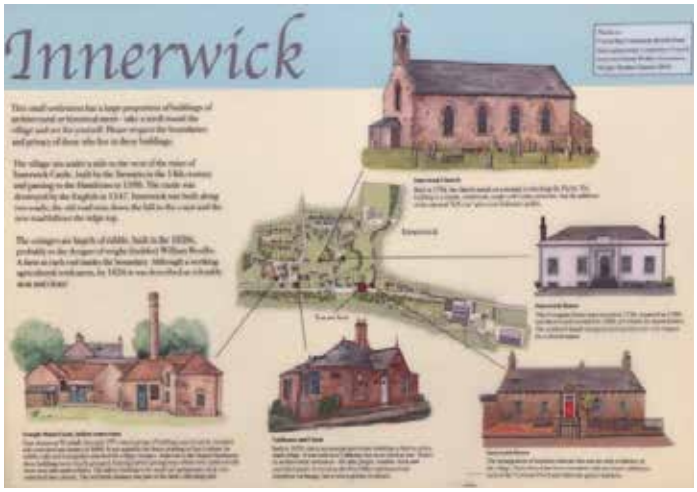
Innerwick Conservation Area covers around 50 homes, and there are 14 listed buildings.

Innerwick has a typical mix of rural properties: pre-1900 stone one-storey cottages and houses, including some that are partially 'back-to-earth' where they are one storey at the front and two at the rear.

There is a 2008 steading development (see next page) and two infill new builds, plus two homes under construction.

With a coastal / rural / woodland location and a mix of housing types and constructions,, Innerwick is an example of a 'typical' Scottish village, making it a good candidate for a demonstrator project.

Main Street



Interpretation Board on Barns Ness Terrace

Manse View

Innerwick Village Hall

Barns Ness Terrace

Kirk Brae

Technical Report

The Innerwick Area

Steadings and Terraced Conversions

There are two Steadings conversions in the area; Temple Main Steading in the village, and Hunter Steading.

Each are formed from an existing stone building, and have been rebuilt to form contemporary living accommodation.

Crowhill was converted in the late-2000's from a row of single storey farm cottages, to form a terrace of contemporary 1 1/2 storey homes. A successful planning application for the steadings to the rear of the cottages could form further accommodation.

Temple Mains Steading converted in the mid-2000's forms 11 homes, retaining some of the stone structure of an agricultural cluster and adding buildings in a courtyard pattern to form a contemporary steading pattern. The historic chimney structure has been retained as a feature and landmark.

Hunter Steading was converted in the early 2000's to form 20 homes in the shell of a former stables.

Crowhill

Crowhill

Hunter Steading

Hunter Steading

Temple Mains Steading

Temple Mains Steading

The Innerwick Area

Pre-1919 Dwellings

There are over 50 homes recorded in EPC data as constructed pre-1919, equating to 25% of all homes in the area. While we cannot extrapolate to the 30% of homes with no EPC, many of these have solid stone walls, evident from visual inspection.

The high proliferation of stone-built homes is typical of villages in the Lothians and elsewhere in Scotland, and these homes contribute greatly to the character of villages and clusters, both through the high quality heritage materials, individual designs, and positioning in relation to the streets and spaces they address.

In Innerwick, the facade of the building often sits hard against the footway, defining the street edge. Spaces between buildings varies. In some cases the space between manages level difference. There are some homes which are harder to access for larger vehicles, which could present a challenge to significant works.

Pre-1919 homes can be classed as 'hard-to-treat', they are often a bespoke design and over time householder upgrades and changes are made which resist a neat categorisation and analysis as groups.

While we recommend all homes have a plan for upgrades, it is particularly important for pre-1919 homes which carry a greater risk of becoming an unhealthy internal environment if unplanned upgrades take place. Moisture movement and airtightness must be taken into careful consideration, along with microclimate, and use pattern. In a building with a high form factor* managing interfaces, details and junctions becomes more complex.

There is a huge potential benefit to upgrading the fabric of these relatively lower-performing homes, both for the health and wellbeing of residents, and in reducing fuel costs and heat loss.

**complex wall, roof and window geometry, eg chimneys, bay windows, protruding porches, roof dormers*

Smithy Cottages

Main Street

Tyme Cottage

Templelands Leigh

The Innerwick Area

Manse View

Post-1919 Dwellings

Built in multiples or clusters, post-1919 homes in the area share characteristics with their neighbours.

Manse View is mixed-tenure, with 16 houses and bungalows, at least three of which are in private ownership. Four homes are managed by East Lothian Housing Association.

Council housing was built in 2 tranches in 1931-2, and 1938-9. They are in the 'garden city' design used all over the UK. There has been some piecemeal retrofit and upgrades.

A further 5 houses were built in 1994 by East Lothian Housing Association. All have solar panels.

Kirk Brae: 2 and 3 bed single storey council housing was built in three stages between 1948 and 1953. Of the original 12 bungalows, 7 have been externally insulated. Two semi's have one half external insulation.

Other Council homes have cavity wall insulation, all have roof insulation and new windows and door. Tenants were given a choice of air source heat pumps and modern electric heaters.

The six council houses (known as 'Cruden Rurals') were an experimental construction in the 1950s. The original steel exteriors have been improved by external brickwork.

Thorntonloch Holdings is a cluster of 21 homes, straddling the A1. They were built in conjunction with smallholdings given to disabled and shell shocked WW1 veterans. From visual inspection, they have a suspended floor, and underfloor heating originally heated via back boiler.

Barns Ness Terrace

Kirk Brae - home to the right has external wall insulation up to party wall

Kirk Brae - Cruden Rural type

Thorntonloch Holdings

Technical Report

Innerwick Area Maps

Innerwick Area Maps

Skateraw

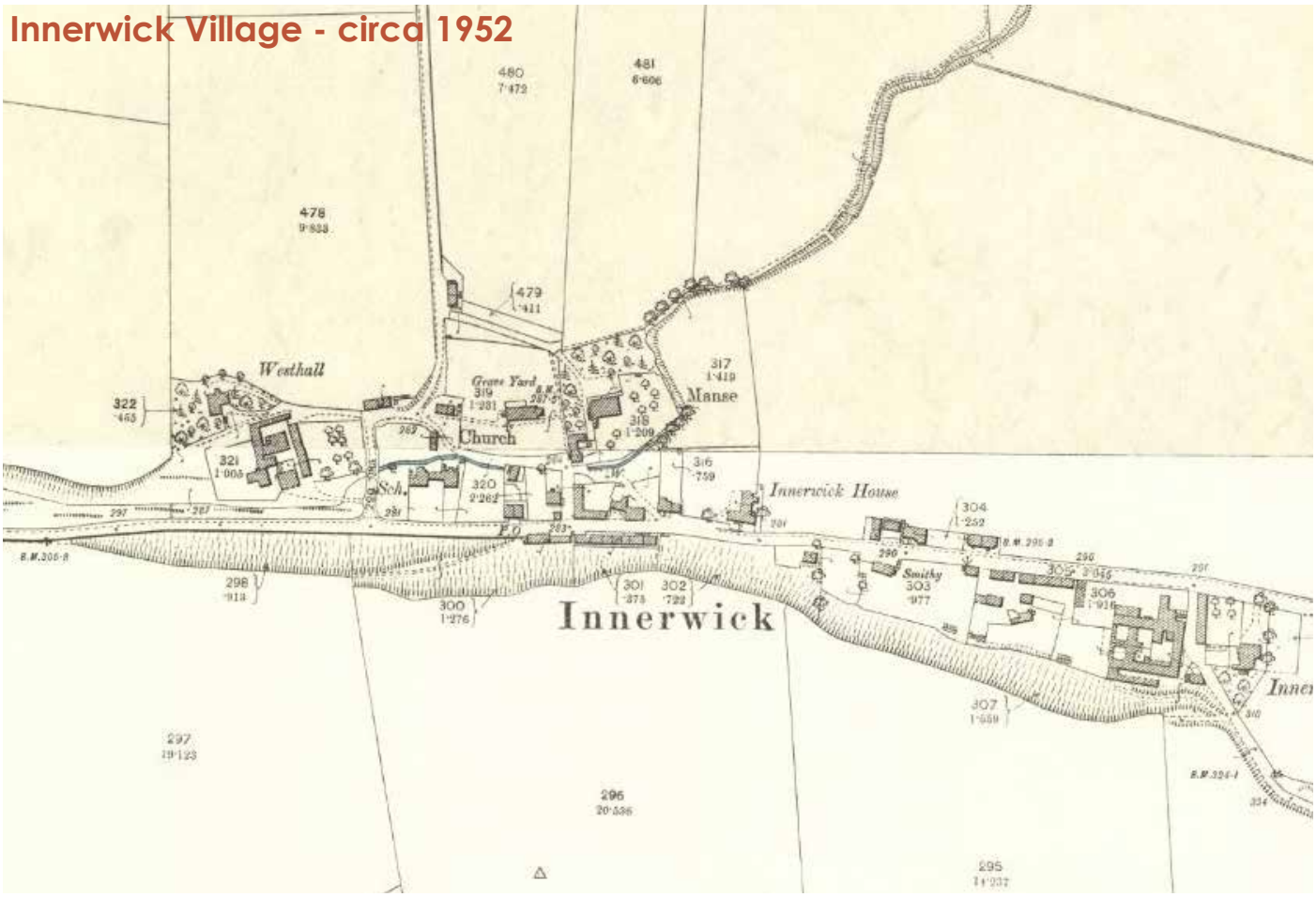
Thorntonloch Holdings

Innerwick Area Maps

Crowhill

Thurston Mains

Innerwick Area Maps - historical



The Flensburg Study - summary

The feasibility stage was kick-started in early 2023 by the work undertaken by four Engineering Masters students from The Europa University Flensburg, Germany. The MSc programme in Engineering, Energy and Environment Management arranged for 16 of their students to undertake 5 weeks fieldwork in the Dunbar area, in January and February 2023. All are qualified and experienced engineers. The group of students plus two professors were hosted by Sustaining Dunbar and based at the Dolphin Inn, Dunbar.

As part of the fieldwork four students undertook a case study in Innerwick. They planned to establish the need for insulating and retrofitting homes within the area, and to calculate costs.

The students employed two methodological approaches.

1 - Innerwick Measured Model

A desktop study made extensive use of open source information, using Scottish, UK and EU sources. This was supplemented by on-site visits, and information derived from local knowledge and also the Fourth Statistical Account of East Lothian (2000) about the age, type of building, and number of storeys. Because of time constraints this focused on the most densely populated areas, where each polygon (housing profile) was mapped and categorised. Open source Ordnance Survey information allowed mapping and measurements to be taken.

2 - Generic Desktop Mapping Model

The students used publicly available information about Energy Performance Certificates (EPCs) which - since 2008 - are legally required when a home is constructed, sold or newly rented. An algorithm was produced to calculate the potential need for energy saving improvements.

These two approaches were combined to predict the need for retrofitting and the overall cost.

Results

The students made two recommendations, for “standard” and “ambitious” refurbishment. In each case this would include all necessary insulation, including cavity, external and internal wall insulation as appropriate, plus glazing. Heat pumps were costed separately. These measures would respectively reduce energy demand by 58% and 71% and the cost at current prices for the energy savings measures was estimated.

There were a number of constraints, and the students suggest several ways in which the model could be improved. It would also need be extended to areas not covered (mostly very rural and/or upland), and include energy saving improvements already made. The economies of scale offered by a coordinated project are not included.

The strategy, methodology and technical model can be adapted for any area of Scotland.

See Appendix for details of methodology and outcomes.

The benefits and limitations of an Archetype approach

One approach to retrofitting at scale is to group dwellings with shared attributes for ease of assessment and generic costings. This is known as the 'archetype approach' and is recommended by industry experts.

This approach is useful for assessing an area to look at the overall upgrades required, costs, and supply chain management.

This approach centres on the building rather than the occupant, which is one limitation. Other limits include a disregard of complexities within an archetype such as local climate conditions and aspect, occupancy patterns, and the consideration of past modifications and maintenance.

A workshop run by University of Edinburgh brought together key stakeholders in the decarbonisation of homes. The workshop report was shared with us by Dr Julio Bros-Williamson.

The report suggests we group dwellings by age and wall construction. As with most settlements, homes were built in clusters of the same or similar housetypes.

Before making recommendations for upgrades or retrofit, each building needs a standalone plan, which considers its unique aspects and use patterns.

Adapted from;

Bros-Williamson, J. and Smith, S., 2024. *Applying a retrofit and low-carbon technology archetype approach to buildings in Scotland: Outcomes from the workshop series organised by the School of Engineering and the Centre for Future Infrastructure, at the University of Edinburgh.* University of Edinburgh, Edinburgh, Scotland, UK.

Archetype	Most Common External Wall KEY Archetypes	Coding	Sub-Categorisation Guidance within KEY Archetypes
Common archetypes in Scotland			
1	Pre1919 sandstone house (solid)	SW - SS - 1	Variation of finishes room side
4A to 4E	Timber frame based (block or brick outer leaf)	CW - TF - A	90mm mineral wool insulation (inner leaf)
		CW - TF - B	rigid foam insulation (inner leaf)
		CW - TF - C	expanding foam (inner leaf) - note different types
		CW - TF - D	140mm mineral wool insulation (inner leaf)
		CW - TF - E	Other - e.g. SIPS inner leaf
5	Brick full depth (solid)	SW - B - 1	Variation of finishes room side and outer leaf
6A to 6D	Masonry & block cavity wall	CW - MB - A	Brick outer skin - dense block inner skin
		CW - MB - B	Block & render outer skin - dense block inner skin
		CW - MB - C	Block & render outer skin - LWA block inner skin
		CW - MB - D	Block & render outer skin - Aircrete block inner skin
Non-traditional types			
	NT Cruden Rural		

Technical Report

Statistics
Energy Performance Certificates

Heat in Buildings Strategy - achieving net zero emissions in Scotland's buildings

https://www.gov.scot/publications/heat-buildings-strategy-achieving-net-zero-emissions-scotlands-buildings/pages/3/

'Improving the energy performance of buildings is essential to unlock the rollout of zero emissions heating. Energy efficiency measures alone will not reduce emissions enough to meet our emission reduction targets, but they are a critical precursor to deployment of many zero emissions systems and are vital to supporting households and businesses to reduce their energy costs today. Energy efficiency remains at the core of our heat in buildings policies and programmes, and a fabric first approach continues to be the mainstay of all our fuel poverty interventions.'

'We know that a minimum level of energy efficiency is an important prerequisite and is needed to underpin the rollout of zero emissions heating across all technology scenarios.'

The Scottish Government's Heat in Buildings Strategy requires all homes meet at least the standard of an EPC C or equivalent by 2033, and that all homes use zero emissions heating (and cooling) by 2045

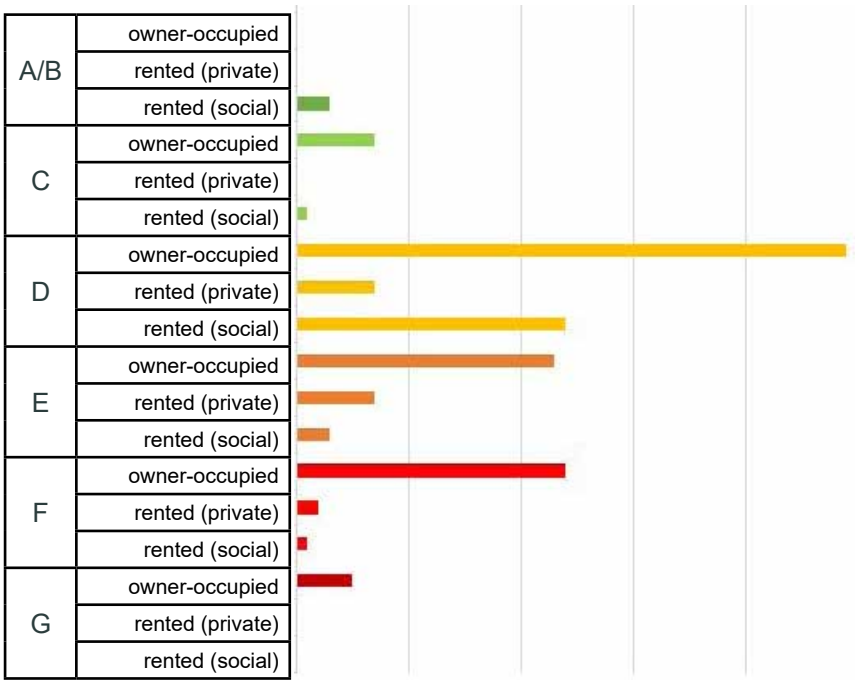
The available EPC data for the area gives a limited overview of the challenge, however we can say for certain that of the 167 homes recorded in this way and captured in 2023;

87% social rent homes are recorded as lower than EPC C

93% owner-occupied are recorded as lower than EPC C

Innerwick EPCs captured 2023

EPC category by tenure



Compared to data in the Retrofit At Scale report published by Sustainable Development Foundation, Innerwick homes perform below the national average.

We will outline some of the many pathways to improve the performance of homes, all of which must centre the householder.

Technical Report

Statistics
Energy Performance Certificates

EPC information was gathered by the Flensburg students and made available to the Insulate Innerwick team.

This data has been analysed to give a snapshot of the village, in order to allow categorisation of the archetypes, and assumptions about the condition of building fabric.

Limitations of the data;

- Out of around 200 known domestic addresses in the study area, only 167 EPCs are recorded. Properties without EPCs have not been sold through a solicitor since January 2004.
- We know EPCs are a blunt tool to assess and make recommendations for dwellings. Much of the information is taken from a visual survey.
- This data cannot be extrapolated, as the condition of dwellings without an EPC cannot be assumed.
- The data on homes does not take into account how people feel lin their homes, nor how willing or able residents are to undertake upgrades.

Historic Environment Scotland. (2023). *Guide to Energy Retrofit of Traditional Buildings.* Revised ed. [PDF]
Available at: https:// historicenvironment.scot [Accessed 20 Aug. 2024].

Our recommendations;

- Many in the construction industry see the limitations of the EPC system. The National Retrofit Hub will shortly publish their recommendations for EPC reform. We recommend following their guidance when published. This is likely to include a ‘fabric rating’ as the most important metric, and a role for the EPC to incentivise performance upgrades.
- We recommend centring the householder rather than the building., To that end, and to improve the accuracy of To improve the accuracy of our data,
- EPCs are not available for 30% of homes, and EPCs are only a snapshot of the dwelling. Accuracy could be improved, and additional data could be more useful to assessing the dwellings’ potential for upgrading.
- Historic Environment Scotland recommend a full assessment of the building should be undertaken by an experienced assessor, using the ‘extended data’ options, to ensure accurate and useful information informs a plan for the dwelling.

https://nationalretrofithub.org.uk/

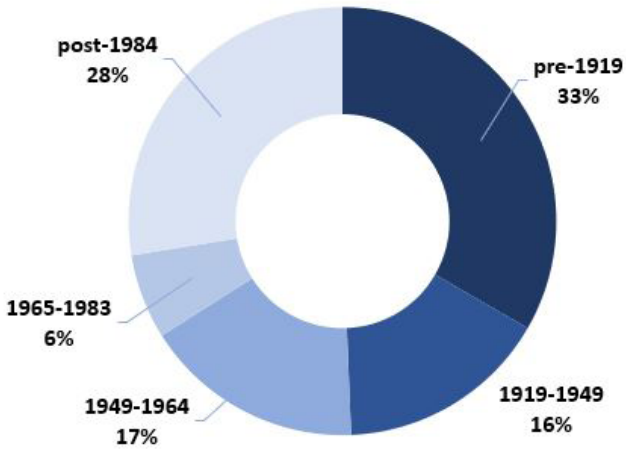
We have subsequently surveyed residents about their home and energy use, which informs our action plan. The information we have gathered looks at key building elements, as well as — crucially — how comfortable people feel in their homes.

Analysed, anonymised data will be available in due course, as a separate report.

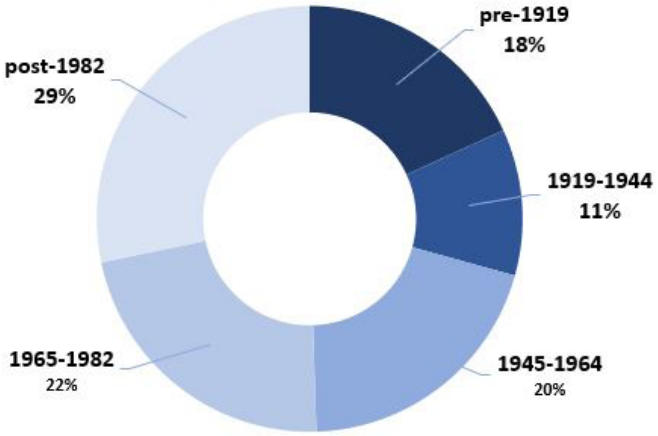
Statistics
Dwelling age and tenure

There is a higher percentage of pre-1919 homes compared to the Scottish average.

Age of Dwelling - Innerwick area

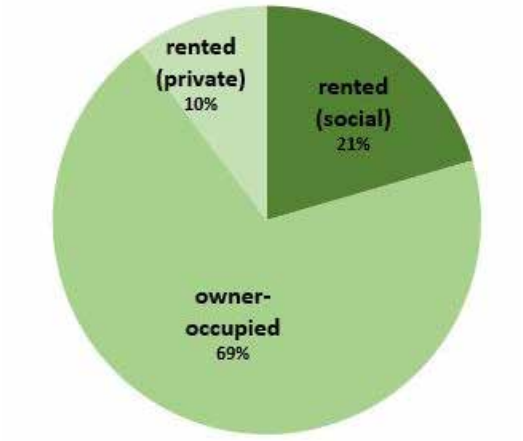


Age of Dwelling - Scotland

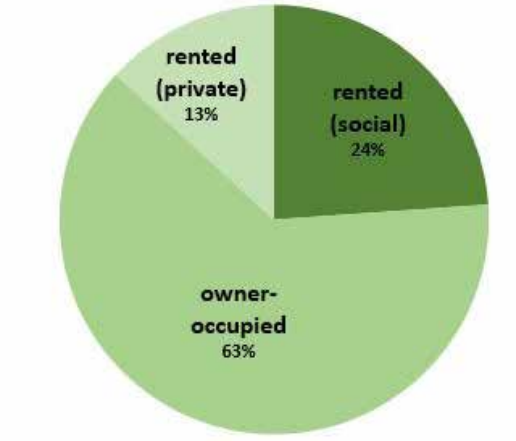


The tenure of homes is generally comparable to the Scottish average.

Tenure - Innerwick area

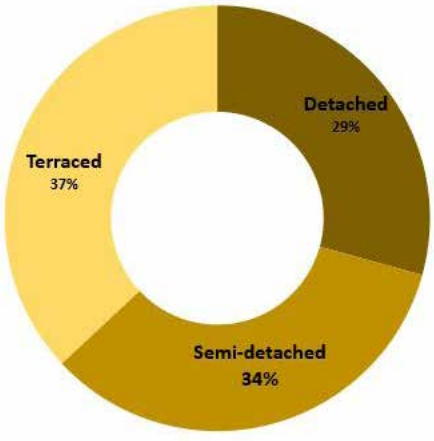


Tenure - Scotland

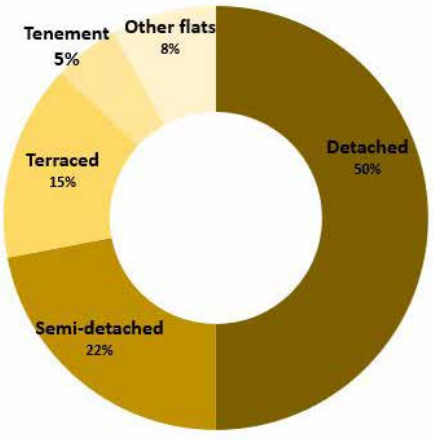


There is a greater proportion of semi-detached and terraced homes in Innerwick compared to the rural Scotland as a whole.

Dwelling type in Innerwick area



Dwelling type in rural locations - Scotland



Technical Report

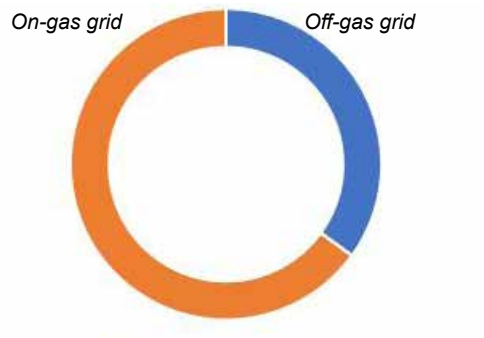
Statistics
Fuel types

https://www.gov.scot/publications/scottish-house-condition-survey-2022-key-findings/pages/1-key-attributes-of-the-scottish-housing-stock/

All dwellings in the Innerwick area are off-mains gas. This puts residents at a higher risk of fuel poverty and is a concern for future fuel resilience.

Around 60% of Scottish rural homes have are off-mains gas.

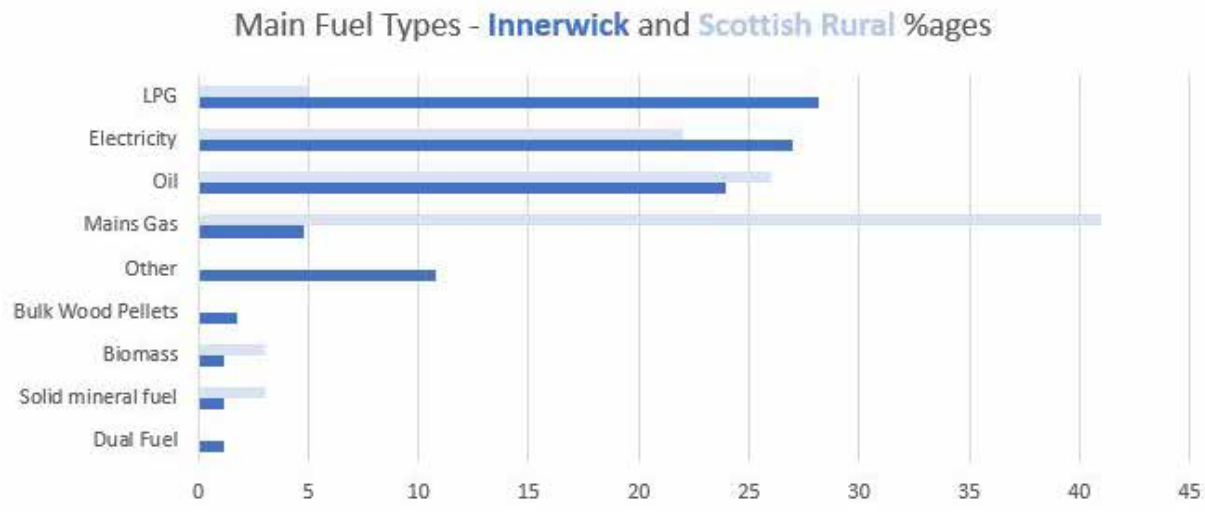
Dwellings' Gas Supply - Scottish Rural



Residents use a wide range of fuel types, many rely on deliveries of LGP or solid fuel.

There is a local district heat network between homes in the village, installed and run by the landlord of a cluster of homes, this is fuelled by biomass harvested as a waste product from the farm, a great example of circularity which is appropriate for this rural location. This solution would not be sustainable, however, in an urban

Source; EPC data, known to be inaccurate



Technical Report

Review of pathways

Our homes are the place we should feel safe and comfortable.

Buildings don't use energy, people do. Every home is a working system of fabric, utilities and services, providing much more than shelter for the inhabitants. We must not do retrofit 'to' a community, and we would never experiment with people's homes.

Our approach to retrofit at scale centres the householder at every stage, informing and empowering people to make the right decision at the right time for them to suit their goals, lifestyle, and family.

We aim to improve health and wellbeing, and reduce fuel poverty by improving the energy efficiency of homes, and allowing decarbonisation of heating systems.

There are various performance and measurement standards indicated by the impartial group Low Energy Transformation Initiative (LETI).

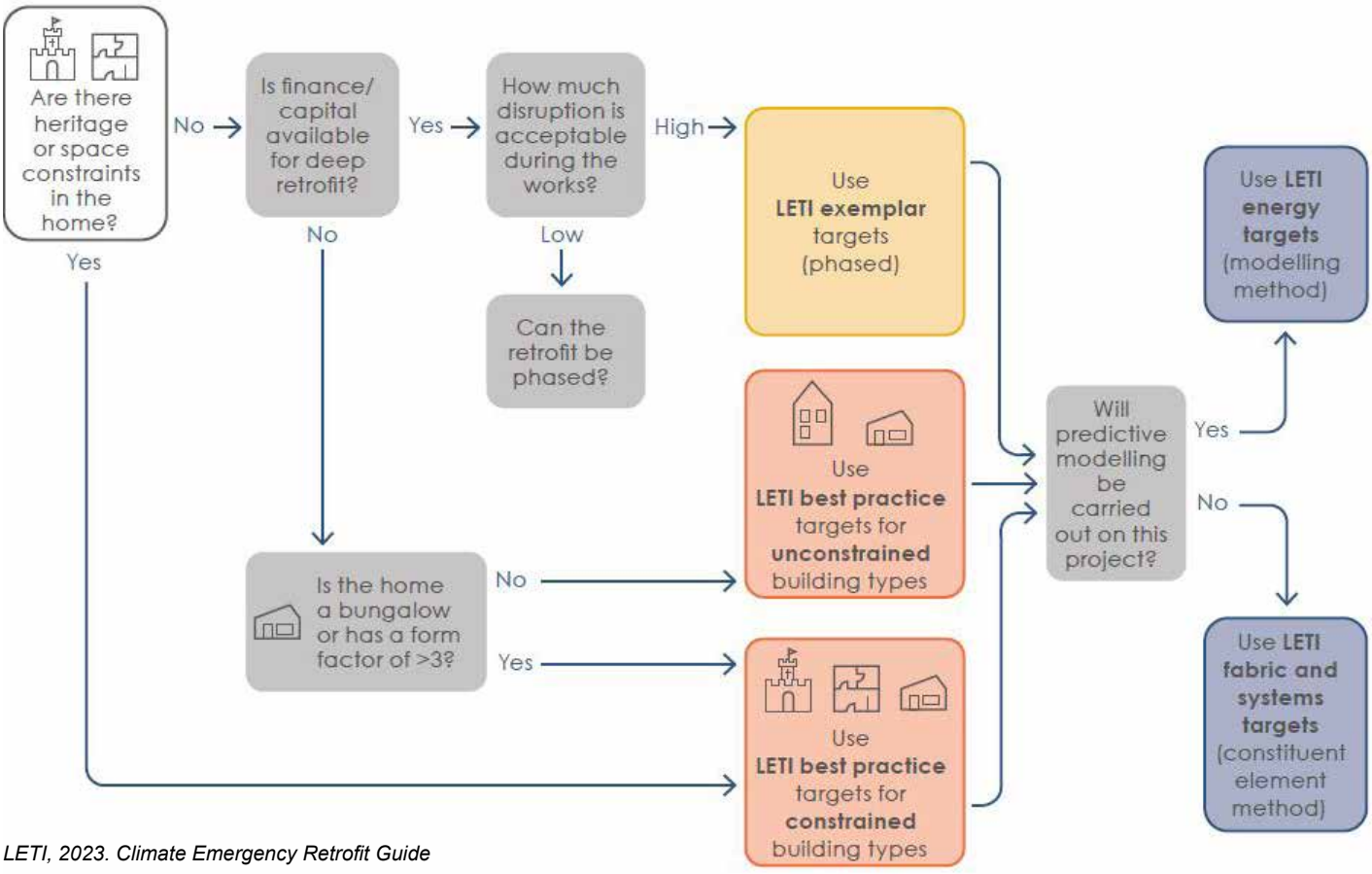
LETI, 2023. Climate Emergency Retrofit Guide. [PDF] Available at: https://www.leti.london/retrofit [Accessed 4 September 2024].

Twinn, C. and contributors, 2023. Retrofit-at-Scale: Upgrading Our Homes to Meet UK Climate Targets. Sustainable Development Foundation. Available at: https://sdfoundation.org.uk/news/retrofit-at-scale [Accessed 23 Aug. 2024].

Fabric first approach

All options presented here centre a "fabric first" approach. This involves surveying the existing building, analysing performance and identifying where upgrades can be made to the building elements. *'Best practice retrofit is fabric first, improving fabric energy efficiency before introducing low carbon technologies. Best practice retrofit can be carried out in one go, or phased according to a well considered Retrofit Plan.'* LETI

We recommend utilising LETI's guidance for performance targets when assessing retrofit options.



LETI, 2023. Climate Emergency Retrofit Guide

Review of Pathways

While the assessment, design and delivery process follows a linear path, there are multiple pathways for householders.

All can be accommodated within the framework, and the first step is always to assess the home with an appropriate survey.

Pathway	Householder Journey
Small measures – DIY	
Small measures are removable changes to the building, eg thick interlined curtains, draught proofing to windows and doors, shutters and blinds, chimney stuffers. Loose loft insulation blankets may be included in this category.	*There can be huge benefits to managing cold-spots, draughts and colder weather through DIY reversible methods.* *Changeworks provided packs of small measures to folk who attended the 'Meet the Experts' event, including draught excluders, radiator foil, and LED bulbs. Measures were easy to install, with clear instructions.* *DIY measures can help empower residents to make more significantly beneficial upgrades.*
Upgrade while you improve - step-by-step retrofit	
It's possible to make step-by-step changes to upgrade the fabric of a home while at the same time improving the accommodation. 'Improvements' may include new bathrooms and kitchens, larger maintenance projects, extending the ground floor or the whole building, replacing cladding or repointing, or replacing an older boiler.	*All homes need improvements from time to time. These changes can be disruptive, and require planning and funding.* *Residents will experience relatively less disruption if they make energy efficiency upgrades, and the aesthetic benefits will be evident.*
BASIC Retrofit	
The impartial group Sustainable Development Foundation have published a guide to BASIC retrofit, which aims to provide guidance for a 'good enough' building performance. 'BASIC is intended to be a performance standard and not a set of prescriptive retrofit measures... BASIC aims to deliver a 50% heat demand reduction averaged across the stock for a cost that is a third of typical current best practice... and be applicable to two thirds of UK homes.'	*BASIC retrofit is likely to include wall insulation, appropriately designed for the dwelling's construction, age and designation. For example, a solid stone building in the conservation area may receive internal wall insulation to street-facing elevations, and less disruptive external wall insulation to the rear elevations.* *The dwelling's improved efficiency will make a lower-carbon heating system economically viable for the resident.*
Deep Retrofit	
Deep retrofit achieves very high performance, we assume a reduction in heating demand of over 70%. When considering a deep retrofit, this is likely to be more invasive and disruptive to the resident, however the results may be worth the challenge, depending in the context. *Deep retrofit may be suitable for a proportion of residents, see LETI flowchart on previous page for details.*	*Significantly increased insulation and airtightness of the dwelling must be carefully managed to avoid issues of moisture movement, so a deep retrofit is likely to include careful sequencing of work.* *Deeper measures could involve greater disruption, however the overall benefits of improved comfort, lower bills, and improved internal air quality will be felt by the resident.*

Less disruptive
Lower impact

More disruptive
Greater impact

Review of Pathways
How the project may progress

While the process of analysis, planning and undertaking works will be managed in a linear progression, the process of driving demand may be piecemeal as residents have need to engage with the project.

There are a number of scenarios, all or some of which may occur.

Our plans are flexible enough to manage all scenarios and achieve positive outcomes.

Early Adopters	
Early adopters who have already started home renovations, live in a lower performing home, have recently moved, or have other motivations for making changes will be somewhere on the journey to home upgrades already. *These folk are likely on our radar already, on our mailing list or otherwise in touch with the project team.*	*It makes sense to contact early adopters first, to catch opportunities to manage work in an 'upgrade-as-you-improve' scenario, minimising disruption.*
Those in, or at a high risk of fuel poverty	
We aim to move everyone out of risk of fuel poverty, however many will be already in a situation of unaffordable bills. *All homes are off-gas in the area, increasing the risk of fuel poverty and reducing fuel resilience.*	*We will continue to reach out using all our platforms to ensure we spread our message to those who need help most.* *IPWA are committed to the welfare of residents, and continue to signpost help.* *We hope to break down any barriers - lack of time, communication barriers - and provide a local, friendly face to help manage the situation and make a robust and deliverable plan with the appropriate support in place for all households.*
Spatial clusters	
Making a coordinated plan for similar homes in a cluster achieves economies of efficiency. *All residents can benefit, if the residents are supported appropriately throughout the process.*	*All residents in a cluster would be contacted - either door knocking, or through the post - and invited to engage as individuals or ideally together as a group, to collate their ambition and barriers.* *Individual plans would be created, based on shared information and with an economy of scale achieved.* *Work packages could be bundled to attract a wider pool of tenderers.* *We would never suggest to impose change on someone's home, or make plans for individual dwellings which didn't involve and centre the residents.*
Similar homes within an archetype	
As above, there are economies of effort and time to be gained through assessing similar homes as a package. *An alternative approach is to use the learnings from one home to inform recommendations for a similar building type. This has limitations, however details and materials if applied correctly as part of the overall plan for an individual dwelling, will have benefits.*	*With each plan that is created, we will build a library of methods, lessons, details and materials which can be applied to the next technical challenge. This information will be anonymised.* *There is a parallel strand of measuring impact and learning from each other.*