Appendix 4: Datasets and LHEES Methodology

1. Datasets used in the development of this LHEES

Data Resource/Tool	Description	Data Format	Weblink
Scotland Heat Map (SHM) (Summer 2020)	Valuable spatial dataset with point-level heat demand data for all properties in Scotland / various other useful data fields and additional information layers. Updated approximately annually. Source data (including from public sector) requested at each update.	Spatial geodatabase	https://www.gov.scot/publications/scotland-heat-map-documents/
Home Analytics v3.7 (Feb 2021)	Database covering all domestic properties in Scotland, built using information from the domestic EPC register and other sources; statistical models are used to provide estimates giving 100% property coverage	Excel spreadsheet	https://energysavingtrust.org.uk/service/home-analytics/
Non-Domestic Analytics (version 1.1)	Database covering all non-domestic properties in Scotland, built using information from the non-domestic EPC register and various other sources, with extensive modelling to provide estimates giving 100% property coverage	Excel spreadsheet	
Portfolio Energy Analysis Tool (PEAT)[VS1]	Tool to accompany Home Analytics; can be used to investigate and cost intervention options for a portfolio of up to 500	Tool hosted online; input /	https://homeanalyticspeat.est.org.uk/

	properties; can be driven by a price cap or a target EPC score	output as Excel spreadsheet	
One Scotland Gazetteer (OSG) - Address Gazetteer (AG)	Central database for all addresses within an authority	GIS API or csv file	
Local Development Plan sites	Information, ideally in spatial format, on development sites in the LDP and LDP2. To include detail on development type and expected build-out where available.	GIS shapefiles	
Waste sites capacity tool (SEPA)	SEPA waste heat data	Online interactive map viewer/ Excel spreadsheet	https://www.sepa.org.uk/data-visualisation/waste-sites-and-capacity-tool/
Green Heat in Greenspaces (GHiGs)	GHiGs investigated the suitability of many types of urban open space across Scotland for use as low carbon heat sources, heat storage sites and heat transmission corridors.	Excel spreadsheet	https://www.greenspacescotland.org.uk/introducing-ghigs#:~:text=Green%20Heat%20in%20Greenspaces%20(GHiGs)%20is%20a%20project%20within%20the,Scottish%20low%20carbon%20heat%20transition
Geographic boundary datasets	Information, ideally in spatial format, on council-owned assets.	GIS shapefiles	https://borders.ukdataservice.ac.uk/bds.html

2. Datasets and limitations of the LHEES approach

Home Analytics

Home Analytics Scotland provides essential data on the Scottish housing stock. This data is provided down to the address level and is available to the Scottish Government and local authorities to assist them in developing, targeting and delivering policies, schemes and programmes designed to improve energy efficiency, install renewable technologies and alleviate fuel poverty. The core datasets that make up Home Analytics Scotland are:

- Energy Performance Certificate data
- Home Energy Efficiency Database (HEED) data
- Energy Saving Trust Home Energy Check (HEC) data
- Ordnance Survey AddressBase, MasterMap Topography layer and StreetMap data
- Scotland Gas Networks data
- Scottish Census data
- Scottish Index of Multiple Deprivation (SIMD) data

While there is full coverage of the Council's property stock, the data is not entirely accurate given that not all properties are surveyed; where gaps exist property information will have been estimated based on neighbouring characteristics using statistical modelling.

Fuel poverty figures in the dataset only act as an indication. To date, there has not been a comprehensive dataset detailing fuel poverty given the resources required to do so and the risk of identifying individuals and communities through the use of sensitive information such as income data. The fuel poverty data is therefore probability driven and users should not treat figures as an absolute number or percentage but rather a likelihood of fuel poverty. An instance where fuel poverty data lacks confidence and leads to a poor representation of the geographical area is in households in affluent areas who may be labelled as in fuel poverty because they live in stone buildings with poor heating capture.

Currently, fuel poverty data is calculated by the following:

- Probability of wall being uninsulated
- Loft Insulation Prediction
- Loft Insulation: 0-99mm
- Loft Insulation: 100-249mm
- Loft Insulation: >250mm

- No loft
- Excess Cold Category 1 Hazard
- Probability of Fuel Poverty (Fuel Bill >10% of Income)

Non-domestic Analytics

Non-domestic Analytics is a new data set developed by Energy Saving Trust on behalf of Scottish Government, to provide more property-level details about the non-domestic building stock in Scotland. The dataset brings together property details from a variety of data sources such as the Scottish EPC Register, Ordnance Survey, Scottish Assessors and BEIS, to establish property attributes and energy profiles for each non-domestic building. Like Home Analytics, gaps in these records are imputed using a series of statistical models. The final database is therefore a combination of known and modelled records.

There are limitations on the confidence of using Non-Domestic Analytics due to the lack of robust information from the non-domestic sector compared to the domestic sector with much of the data relying on significant modelling. Therefore, users should not take figures as an absolute number or percentage but rather an estimation. Due to the reliance on probability, analysis was limited to exploring groupings of building typologies.

The dataset relies on the use of an external categorisation of property typology (Ordnance Survey) resulting in a deviation in standard interpretation of property classes. For example, church can be classified as either a commercial or place of worship depending on its main function, while residential (non-domestic) buildings can also indicate short-term lets and sheltered accommodation.

Scotland Heat Map (2020)

Containing both domestic and non-domestic heat demand data, the Scotland Heat Map is an important resource to identify the opportunities for efficient heat supply projects and support their development. Developed with data provided by public and private sector organisations including all local authorities, it will help to identify opportunities for new and expanding heat projects including efficient supply projects, such as district heating. The dataset also contains various additional layers such as Geology and hydrogeology, waste energy supply points, and existing heat networks.

As the dataset was captured in the summer of 2020, demand data exists only as a snapshot in time. Since network viability is based around the demand of individual buildings, the difference between modelled and expected demand may affect that viability.

PEAT-OR tool

The PEAT-OR tool, developed by EST, accompanies Home Analytics. It is used to investigate cost intervention options for a portfolio of up to 500 properties. The tool has a relatively high degree of flexibility to be tailored to reveal target areas and properties by price cap or a target EPC score.

However, there are the following limitations:

- Individual measures cannot be isolated or removed, the tool will show all possible interventions. This means some impractical measures are proposed such as installing wind turbines
- Costs and Carbon savings are calculated for all possible measures, this means it is not possible to investigate the impact of individual measures
- Fuel cost data used within PEAT-OR was released at the start of July 2023, with fuel costs modifying frequently these costs are not totally accurate

These limitations will affect the outputs from Stage 5, which should be understood as estimates only.

Ordnance Survey

Various mapping data, central to the development and use of Scotland's Heat Map and other GIS information sources. OS product data and licenses are required to use SHM & other OS-derived datasets. Key to GIS analysis elements of LHEES.

One Scotland Gazetteer

Central database for all addresses within an authority. Key to GIS elements of LHEES for identifying multi-tenure non-domestic properties.

3. LHEES Stage descriptions

Stage 1: Policy and Strategy review

A policy review was carried out to highlight national, regional and local policies that are linked to, impact, or could be impacted by LHEES. Results from this review, along with initial stakeholder mapping were logged in the policy review template for reference during subsequent Stages of the LHEES.

Stage 2: Data and tools library

This Stage involves identifying and maintaining a record of the data and tools used to support analysis in the subsequent Stages of the LHEES process. The record captures data sources, ownership rights, requirements for the LHEES Considerations and data format.

Stage 3: Strategic zoning and pathways

The purpose of LHEES Stage 3 is to support local authorities to understand the current energy efficiency and heat decarbonisation performance of the building stock at a local authority wide level. It also supports further analysis to set out Strategic Zones and pathways for each LHEES Consideration, as far as reasonably possible, at data zone level, a commonly used standard for statistical reporting of socio-economic data.

These Strategic Zones identify potential solutions for inclusion in the LHEES Strategy (Stage 7). The analysis sets out the strategic starting point for the generation and prioritisation of Delivery Areas (Stage 4), as well as further engagement and actions for the Delivery Plan (Stage 8).

LHEES Stage 3 is supported by both the 'Domestic Baseline Tool' and the 'Non-domestic Baseline Tool'. The Domestic Baseline Tool was developed by Zero Waste Scotland for analysis of the domestic sector drawing on Home Analytics as the core source data to support this. The tool was used to generate a performance baseline of buildings and to set out Strategic Zones with respect to the LHEES Considerations. The 'Non-domestic Baseline Tool' was developed following the release of Non-Domestic Analytics, as a means to support better understanding of the breakdown of non-domestic building typologies and by other criteria, such as age, heating system type or floor area category. Given the limitations of the non-domestic dataset, the outputs are focused on providing property count and / or total heat demand information for these groupings, rather than suggesting suitability for specific interventions.

When assessing heat decarbonisation options in the tools, heat pump installation is one of the suggestions. According to the LHEES methodology, the level of heat pump 'readiness' in domestic properties are sorted into four categories:

Building category	Description
Category 0	Currently have a low or zero direct emissions heating system, or heat network connection
Category 1	"Heat pump ready" buildings that are well-suited to heat retrofit with minimal other changes.
Category 2	Secondary potential for heat pump retrofit. Require some fabric and/or distribution systems upgrades.

Category 3	Significant upgrades required to be heat pump ready.

In the standard Zero Waste Scotland methodology, Category 1 properties are assessed based on a range of indicators including wall insulation, glazing status, wet heating system and loft insulation prediction. For South Lanarkshire's LHEES, only wall insulation was accounted for in Stage 3 given that this was the most relevant factor to the local domestic property stock.

Stage 4: Generation of initial Delivery Areas

Stage 4 is informed by the LHEES Strategy and analysis from Stages 1-3. The purpose of Stage 4 is to support the Council's decision making by generating initial Delivery Areas for each of the LHEES Considerations. This Stage uses GIS to generate initial Delivery Areas at a higher granularity than LHEES Stage 3, to enable the Council to understand specific locations of potential Delivery Areas within a Strategic Zone or across the whole local authority. The level of granularity is advised at 250m2 to reflect an appropriately sized delivery area without the risk of identifying individual properties.

This analysis is the starting point for more detailed engagement, building level assessment of interventions and cross-checking against the policy and Strategy review (Stage 1) to enable finalisation of the Delivery Areas (LHEES Stage 6). These Delivery Areas should then support actions in the Delivery Plan (Stage 8) that are within the competence of the Scottish Government, local authorities and wider partners.

Stage 5: Building-level pathway assessment

The purpose of LHEES Stage 5 is to support with delivery area identification of Stages 4 and 6 to establish in more detail the type of intervention(s) required to decarbonise the building from a heating and energy efficiency perspective. This Stage provides an understanding of the costs and the energy and carbon savings associated with interventions.

Stage 5 enabled Shetland Islands Council to select and analyse domestic buildings for assessment in the Energy Saving Trust's PEAT-OR, for the domestic sector only. PEAT-OR enables the local authority to evaluate energy efficiency and heat decarbonisation retrofit options in terms of costs and carbon emissions reduction. Results can be presented at the building level or at a zone level. The buildings to be evaluated can be selected and taken from the analysis in LHEES Stage 3 or Stage 4.

It is recognised that PEAT-OR has not been designed specifically to support LHEES. Therefore, in this LHEES, a PowerBI report has been developed to enable the Council to explore potential decarbonisation results in an interactive and customised manner to assess viability and decision making of delivery areas.

Stage 6: Finalisation of Delivery Areas

During this Stage, Strategic Zones, initial Delivery Areas and any building-level assessment were considered alongside the detail included as part of the policy and Strategy review and all stakeholder engagement undertaken. The outcomes from this Stage are documented in the Stage 8 Delivery Plan.

4. Deviations from the standard LHEES methodology

LHEES Consideration	Standard methodology	Deviation from standard LHEES method
Off-Gas Grid Buildings	Categories 0, 1, 2 and 3 properties determined according to the following factors: • Unlisted property • Not in a conservation area • Wall insulation • Double/triple glazed windows[1] • Wet system replacement (except electric and no heating/hot water systems) • Loft insulation prediction (99mm +)	Only wall insulation is considered in determining Category 1 properties for all heating types (boilers, room heaters, storage heaters, no heating/hot water systems). Additionally identified solar PV suitability for category 1 properties.
On-Gas Grid Buildings	Categories 0, 1, 2 and 3 properties determined according to the following factors: • Unlisted property • Not in a conservation area • Wall insulation • Double/triple glazed windows	There are no buildings in Shetland Islands Council that are on the gas grid.

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[1] Glazing and doors will have a bigger impact in Shetland.

	• Wet system replacement (except electric and no heating/hot water systems) • Loft insulation prediction (99mm +)	
Poor Building Energy Efficiency	Energy efficiency score is determined by wall insulation status, loft insulation status and double glazing.	As most programmes and projects are wall insulation focused, the weighted Energy Efficiency map only includes wall insulation potential, not glazing and loft.
Poor Building Energy Efficiency and Fuel Poverty	Energy efficiency and Fuel Poverty score is determined by wall insulation status, loft insulation status and double glazing and Fuel Poverty.	As most programmes and projects are wall insulation focused, the weighted Energy Efficiency and Fuel Poverty map only includes wall insulation potential, not glazing and loft.

5. Detailed methodology for the identification of potential heat network zones

Analysis was undertaken to identify the areas where heat networks present a decarbonisation pathway that could be of strategic importance for Shetland. Heat Data Point non-domestic properties were filtered to only include semi-public and public buildings. These were refined using OS Address Base classification codes identified as semi-public or public by the Green Heat in Greenspaces project. Additionally, a sense check of building names was carried out to identify council-owned buildings. If that was the case, the buildings were added to analysis. This approach was chosen so that only non-domestic buildings that the Council has full or partial control over are treated as potential anchor loads in the heat network zoning. When defining anchor loads, public and council-owned buildings have been prioritised as the Council has greater control over the operation of these buildings.

Heat network zones have been identified based on a 4,000 kWh/yr/m linear heat density (a means of relating annual heat demand to a distance). Areas of

greatest potential for Developing heat networks have been further identified based on a solely heat demand perspective where at least two anchor loads were required > 500MWh/yr.

Further analysis through feasibility studies and constraints analysis were required to understand the viability of Developing heat networks in each identified area. Existing heat networks have been added to potential heat network zones to identify viability of heat network expansion. For the purpose of LHEES, a 500m radius buffer has been drawn around the existing heat network points to provide a sensible estimate of the area within which heat demand can serve.

The methodology for identification of heat networks has been summarised in the figure below. For a comprehensive methodology, please see the Heat Network Zoning methodology in the LHEES documentation.