1.2 CLIMATE MITIGATION

1.2.1 WHOLE-LIFE ENERGY APPROACH

Consider the energy used at all stages of a building's lifespan, including the embodied energy in existing and new buildings.

Consider the end of life in the design of new buildings and include materials and building elements that can be easily reused or recycled.

Use the Sustainability Statement, where required, to demonstrate how design incorporates a Whole-Life-Energy Approach.

For the replacement of existing buildings, submit a Whole Life Carbon Assessment that compares the proposed development to the option of re-using the existing building to accommodate the proposed use.

City Plan 2030 policies

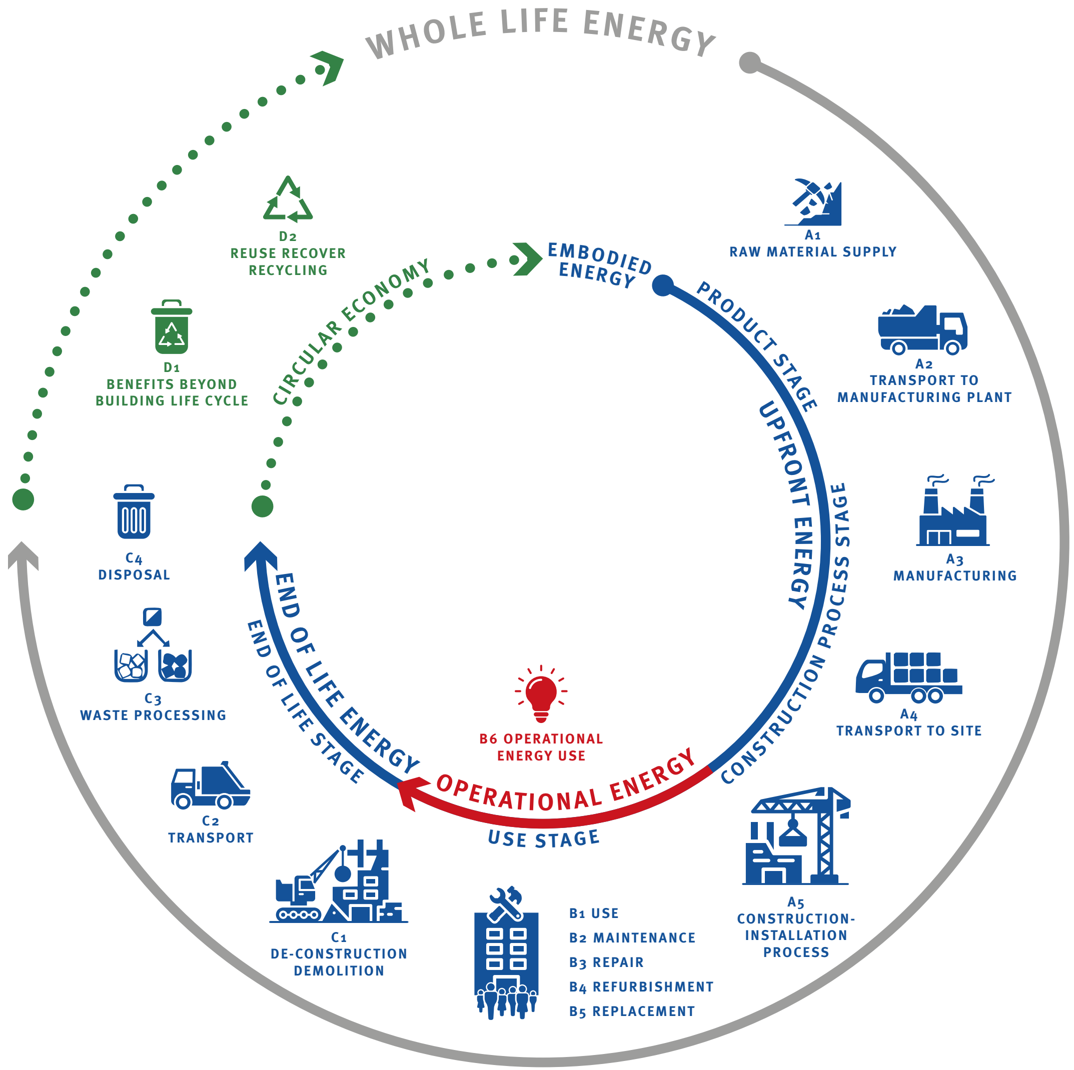
Env 7 - Sustainable Developments

Env 8 - New Sustainable Buildings

NPF4 Policies

Policy 2 – Climate mitigation and adaptation

The embodied energy is the energy involved in the sourcing of materials, transportation, and construction of the proposed design. It includes the building and surrounding landscape. It also includes any replacement materials or components that are needed over a building's lifespan and the energy used to dispose of materials at the end of a building's lifespan.



Whole-Life Energy Approach *- This diagram highlights the different stages across the lifespan of a building where energy is used and/or potentially lost.*

A whole life energy approach considers both the embodied energy in the construction of a building and the operational energy during the use of a building. This must be considered across a building's entire lifespan. The longer a building's lifespan the more efficient the expenditure of its embodied energy. This must be balanced against the efficiency of energy in the use of the building. There are many steps that can be taken to make existing buildings more energy efficient.

If materials can be reused at the end of a building's lifespan this reduces the embodied energy lost in demolition. It also reduces the energy involved in disposing of the materials.

Minimise Embodied Energy of New Buildings

The design of a building can reduce embodied energy in different ways. This includes:

- Optimising the layout, such as by considering how many spaces can be shared or multi-functional.
- Reducing the weight of the building to reduce the load on the structure.
- Specifying materials that use less energy to extract and supply, such as natural and renewable materials.
- Specifying materials that are sourced locally and do not require as much energy to transport them to site.
- Transporting materials in methods that use less energy, such as by reducing the number of deliveries and using electric vehicles.
- Considering the use of Design for Manufacture and Assembly for repeated components that can be constructed more efficiently in factory conditions.
- Developing site layouts and foundation designs that reduce the amount of excavation required and include landscaping that can retain excavated material on site to reduce the amount of soil that goes to landfill.

Minimising embodied energy of new buildings - *The extension to Sciennes Primary School was constructed using stone-clad exposed cross-laminate timber (CLT). The use of CLT minimised the embodied energy by using natural materials that contribute to carbon storage. By exposing the CLT internally a comfortable environment was created without needing additional internal finished. The extension was also designed to Passivhaus standard, reducing the operational energy consumption of the scheme. The external stone cladding responded to the setting of the extension next to a category B listed building in the Marchmont Conservation Area.*
Photos courtesy of Holmes Miller, © Chris Humphreys Photography.

Consider Embodied Energy of Existing Buildings

Where it is proposed to demolish and replace an existing building a carbon assessment must compare the whole life green-house gas (GHG) emissions of the redevelopment proposal against retaining and refurbishing the existing building for the proposed use. To prepare this assessment:

- Existing buildings should not be assumed to have a fixed life expectancy.
- The assessment approach should be consistent in both scenarios. Assumptions should be clearly defined.
- Both scenarios should follow best practice to minimise GHG emissions as far as possible.
- Operational GHG emissions should be shown as a range, representing possible scenarios for occupancy and operation.
- Carbon benefits far into the future should be viewed cautiously due to the higher level of uncertainty.

Consider the End of Life of a Building

End of life GHG emissions are those associated with the demolition, disassembly, and disposal of any part of a building. The design should reduce this by including materials that can be re-used at the end of life of the building.

Where materials cannot easily be re-used they should be designed to be reclaimed or recycled.

Technical Guidance

Sustainability Statement

Applicants must complete a Sustainability Statement (S1) form for all applications, except those relating to householder development. *"Appendix 3 - Sustainability Statement" on page 129.* This should include a summary explanation in plain English of the assumptions and conclusions.

Design for Manufacture and Assembly

This design approach seeks to optimise design so that it can be manufactured and assembled more efficiently, quickly and safety. This typically involves using off-site prefabrication.

Whole Life Carbon Assessments

A whole life carbon assessment calculates the GHG emissions that a development is projected to generate over all stages of its life cycle, including any initial demolition, construction, operation, and end of life demolition (including any GHG emissions generated/ saved from construction materials at this life stage through disposal/reuse).

Whole life carbon assessments should follow the RICS whole life carbon assessment standard. They should express the overall impact in terms of tonnes of CO_2. However, all GHGs should be accounted for by converting their impact into CO_2 equivalent.

For a development that is required to submit a Whole Life Carbon Assessment, this should be included as part of the Sustainability Statement.

Best Practice Targets

The Low Energy Transformation Initiative (LETI) sets out best practice targets for 2030 which can serve as a useful benchmark to evaluate levels of embodied emissions:

- Domestic – Less than 300 $kgCO_2/m^2$
- Non-domestic – Less than 350 $kgCO_2/m^2$

These targets are based on at least 50% of materials in new buildings being from re-used sources and that at least 80% can be re-used at the end of the life of the building.

Further Reading

- *RICS – Whole Life Carbon Assessment for the Built Environment*
- *UKGBC – Whole Life Carbon Explainer Guide*
- *UKGBC – Whole Life Carbon Roadmap*
- *LETI - Climate Emergency Design Guide*

Sensitive refurbishment can enhance efficiency and heritage *- These flats on Canongate were refurbished by Edinburgh World Heritage in partnership with City of Edinburgh Council. The B-listed flats were designed by Sir Basil Spence. They were refurbished to improve the operational efficiency, while respecting and enhancing the cultural significance. An MVHR system was installed, along with improved insulation and building repairs. The windows were replaced with double glazed windows that also reinstated Spence's original design*

Retention of existing fabric - *The adaptive re-use of this former factory in Fountainbridge safeguarded a substantial quantity of embodied energy while creating an outstanding new resource for Edinburgh Printmakers, including studios, galleries and a café.*
Photos courtesy Page & Park, © Jim Stephenson,

1.2.2 BUILDING ADAPTABILITY & MAINTENANCE

Design to maximise the physical lifespan of a building by making sure:

- **It can be adapted to the future needs of different occupiers.**
- **The design allows for effective maintenance and repair.**

City Plan 2030 Policies

Env 7 – Sustainable Developments

Hou 3 – Mixed Communities

NPF4 Policies

Policy 14 – Design, quality and place

Policy 16 - Quality homes

Many buildings are designed with specific uses in mind. If the design becomes too specific it can become very difficult to make changes to the building and give it a new use later.

An adaptable building is one that is easily modified to suit the changing and diverse needs of building occupants or alternative future uses. This maximises the physical lifespan of the building by enabling viable alternatives to demolition and reconstruction.

Design for adaptability

The design can maximise the potential for adaptability. This includes:

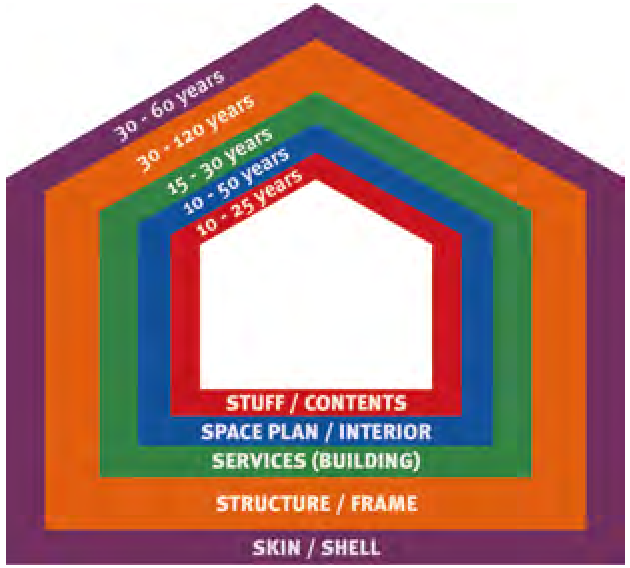
- Designing spaces so they can be re-purposed for different uses in the future in a way that minimises the need for alterations. For example, including partitions or floors slabs that can be re-positioned without compromising the building's structural integrity.
- Incorporating soft-spots or slack space that can be easily adapted to alter and expand the building in the future. For example, designing roof space so that it can easily be turned into floor space.
- Make floor to ceiling heights generous enough (2.6m and above) to accommodate a range of different uses;
- Using modular or gridded designs and avoiding irregular or overly customised spaces.
- Design landscaping that can be adapted to a changing climate.

Adaptable residential development

- Design flexibility into specific residential uses (e.g. Purpose-Built Student Accommodation) so that buildings can be adapted and reconfigured internally and externally to meet the needs of mainstream residential use, including amenity standards.
- Apply Housing for Varying Needs standards to housing design to make sure homes are adaptable to changing and diverse needs of future residents. See *"2.1.2 Housing Mix, Size and Tenure" on page 71*
- Meet the changing needs of households by incorporating space for home-working and generous, secure storage space.

Design for maintenance and repair

- Design service voids to allow sufficient access to cabling and pipework for these components to be easily added, modified, or replaced.
- Make sure that the elements of the building with shorter lifespans can be replaced or repaired without impacting the elements of the building with longer lifespans.



Layers of Change *- The different elements of a building have different lifespans. To extend the overall lifespan of a building the elements with shorter lifespans should be able to be altered or replaced without impacting the elements with longer lifespans. (Please note: Timescales are indicative)*

Adaptable laboratory building: Bioquarter *- This building was designed to allow different types and sizes of laboratory space and all their associated services to be fitted out and changed over time.*

1.2.3 OPERATIONAL ENERGY

Design new buildings for zero-direct operational Greenhouse Gas (GHG) emissions, including:

- **Minimising the energy demand of the building.**
- **Using low and zero carbon generating technology (LZCGT).**

Reduce operational GHG emissions for refurbishment and change-of-use projects.

Use the Sustainability Statement to demonstrate how development will achieve net zero operational Greenhouse Gas (GHG) emissions

City Plan 2030

Env 7 - Sustainable Developments

Env 8 - New Sustainable Buildings

NPF4 Policies

Policy 2 - Climate mitigation and adaptation

Policy 19 - Heat and cooling

Operational GHG emissions are those that are emitted because of a building's energy use. This includes the energy used in heating, cooling, lighting, and ventilating the building, as well as the energy used by the occupants of the building. 'Zero-direct operational GHG emissions' refer to buildings that do not produce any emissions on site. Through a combination of reducing the overall energy demand and using LZCGT it should be possible to reduce the direct operational GHG emissions for new buildings to net zero.

This has the added benefit of reducing energy bills for owners and occupiers.

Minimise Energy Demand

The design of a building can reduce operational energy in different ways. This includes:

- Designing orientation, glazing, and shading to avoid excessive heat loss in the winter and avoid overheating in the summer.
- Considering the ratio between the external exposed surfaces of the building and the internal floor area. The greater the external exposed surface, the more heat that will be lost to the outside.
- Including passive ventilation and cooling methods.
- Using ultra-high fabric efficiency to minimise heat loss.
- Using efficient mechanical and electrical systems.
- Considering the way the building is used by occupants.

Low and Zero Carbon Generating Technology

LZCGT should be used to meet energy demand from a building. This can include renewable energy sources, such as photovoltaic (solar) panels, as well as Zero Direct Emissions (ZDE) heat sources such as air and ground source heat pumps. Depending on the location and design of the building, as well as what nearby infrastructure is available, different energy sources will be appropriate. For example, a taller building will be unlikely to meet the energy requirements solely through photovoltaic (PV) panels, due to the lower ratio between the roof area and the overall building volume.

From April 2024, the Scottish Building Standards require new buildings and some conversions to use to use ZDE heating systems or heat networks instead of direct emission (or polluting) heating systems, such as oil or gas boilers or bioenergy.

In March 2024, in anticipation of this change to the Building Standards, and to exercise its duty under the Climate Change (Scotland) Act 2009, the Scottish Government reported:

- It shall prepare an order to repeal Section 3F of the Town and Country Planning (Scotland) Act 1997, which requires Local Development Plans to contain policies requiring a reduction in emissions from new buildings;
- A review of the Building Standards is underway to deliver a Scottish equivalent to the Passivhaus standard.

In light of the alterations by the Scottish Government to Building Standards regulations, it will not be necessary for the Council to attach a condition to planning permission requiring new buildings to achieve a net zero level of operational greenhouse gas emissions. However, where buildings have exceptionally high operational energy requirements, such as those accommodating energy-intensive uses like swimming pools or data centres, it may be necessary to apply a condition to make sure these energy sources are in place prior to the occupation of the building.

Applicants are strongly encouraged to consider how their buildings will minimise emissions at the outset of the design process to avoid any potential requirement to vary the design to meet the Building Standards.

Where Building Standards will require development to meet its heating demand from a ZDE source or a heat network, this must be reported in the Sustainability Statement that accompanies the planning application.

Technical Guidance

Low and Net Zero Best Practice Standards

Passivhaus is a widely adopted standard for designing buildings that achieve low or net zero operational GHG emissions. The approach combines ultra-high levels of fabric efficiency with a mechanical ventilation system with highly efficient heat recovery.

EnerPHit is an equivalent standard for retrofit schemes, achieving high levels of fabric efficiency and heat recovery while recognising the limitations that come from working with an existing building.

The **Low Energy Transformation Initiative (LETI)** sets out best practice targets which can serve as a useful benchmark to evaluate the levels of energy use intensity:

Residential – 35 kWh/m2.yr

Offices – 55 kWh/m2.yr

Schools – 65 kWh/m2.yr

Note: These targets are based on GIA areas and exclude renewable energy contribution.

LETI also recommends that all new buildings should be designed to achieve a space heating demand target of 15 kWh/m2.yr.

Further Reading

- *Scottish Government - New Build Heat Standard*
- *LETI - Climate Emergency Design Guide*
- *LETI – Client Guide for Net Zero Carbon Buildings*
- *UKGBC – Net Zero Carbon Buildings Framework*

Minimising Energy Demand - Granton Station View. *The development consists of 75 homes for social and mid-market rent. Also on the site are four commercial spaces, communal energy centre, communal bike storage and a private courtyard. The project utilised off-site manufacturing to construct a low energy consuming development. This included enhanced building fabric performance, enhanced window specification using triple glazing, a communal energy centre featuring air source and water-water heat pumps, photovoltaic panels and EV charging. The projected operational energy for space heating is an average 19.39 kWh/m2/year for the flats.*

1.2.4 SUSTAINABLE HEATING AND HEAT NETWORKS

Connect to an existing heat network where available and accepting new connections.

If this is not possible, create a heat network with no adverse impact on air quality; and/or

Use Zero direct emissions heating systems for individual buildings and enable cost effective connection to any planned networks.

City Plan 2030 Policies

Env 7 - Sustainable Developments

Env 8 - New Sustainable Buildings

Inf 16 - Sustainable Energy and Heat Networks

NPF4 Policies

Policy 19 – Heat and Cooling

Heat networks are expected to play an important role in providing heat and hot water to new and existing buildings throughout Edinburgh. The establishment and expansion of heat networks is needed to enable a transition to net zero no later than 2045, in line with *Scotland's Heat in Buildings Strategy (2021)*.

Existing heat networks

There are 153 existing heat networks in Edinburgh as illustrated in the adjacent map.

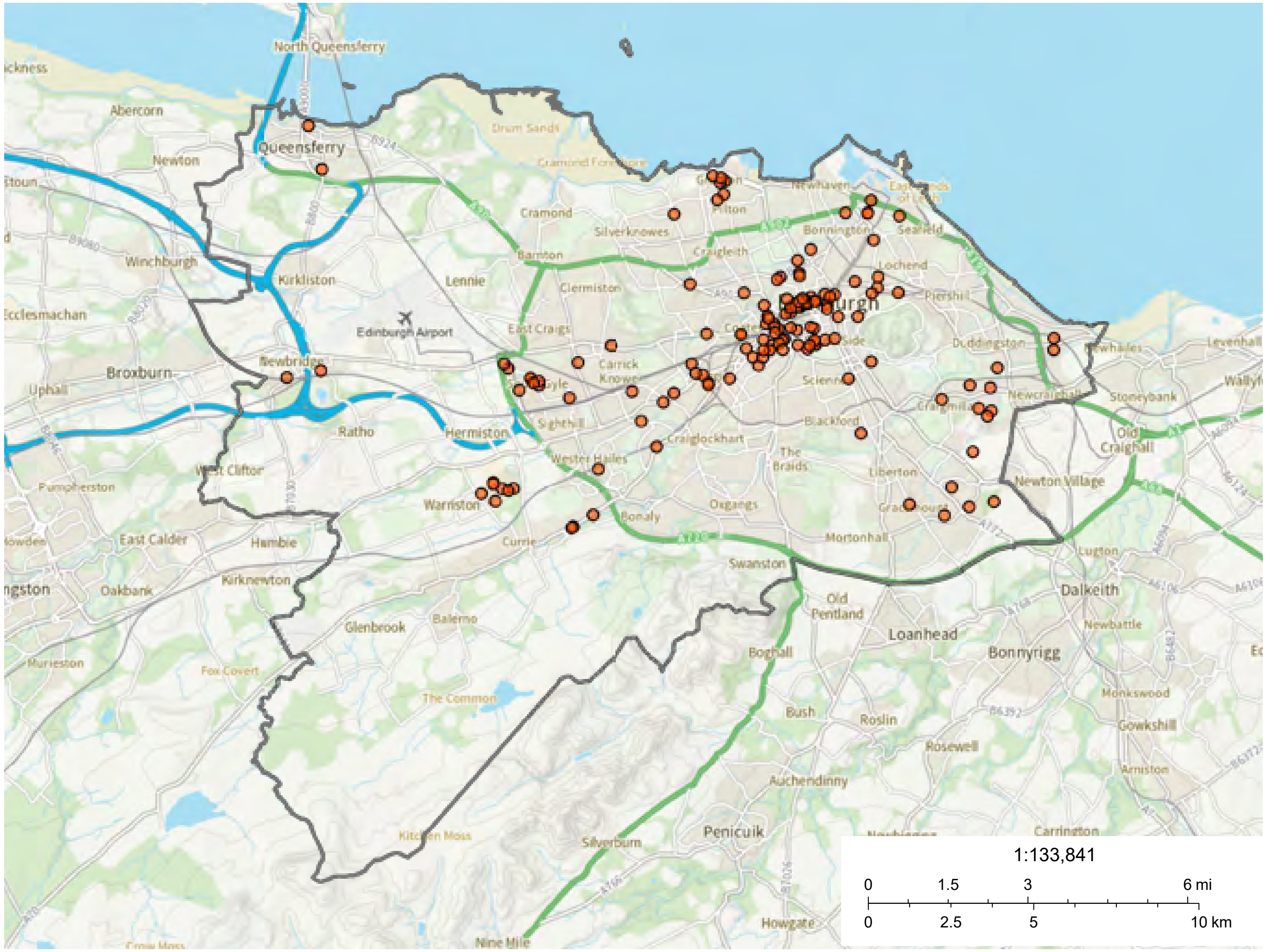
Some networks are not fully de-carbonised, which is accepted as a short-term scenario since many of these networks utilise surplus heat that would otherwise go to waste and/or these networks are expected to be de-carbonised by 2045.

Developments in and/or adjacent to an area containing a heat network that is accepting new connections should connect to it.

New heat networks and sustainable heating systems for individual buildings

Where connection to an existing network is not possible the development should employ:

- a new heat network created by the development with no adverse impact on air quality; and/or
- zero direct emissions heating systems for individual buildings.



Map of existing heat networks and communal heat networks in Edinburgh

Heat network opportunities

Heat networks are particularly well-suited to areas of high residential density, where concentrated demand makes the network more viable.

Heat networks also represent a significant route to net zero for:

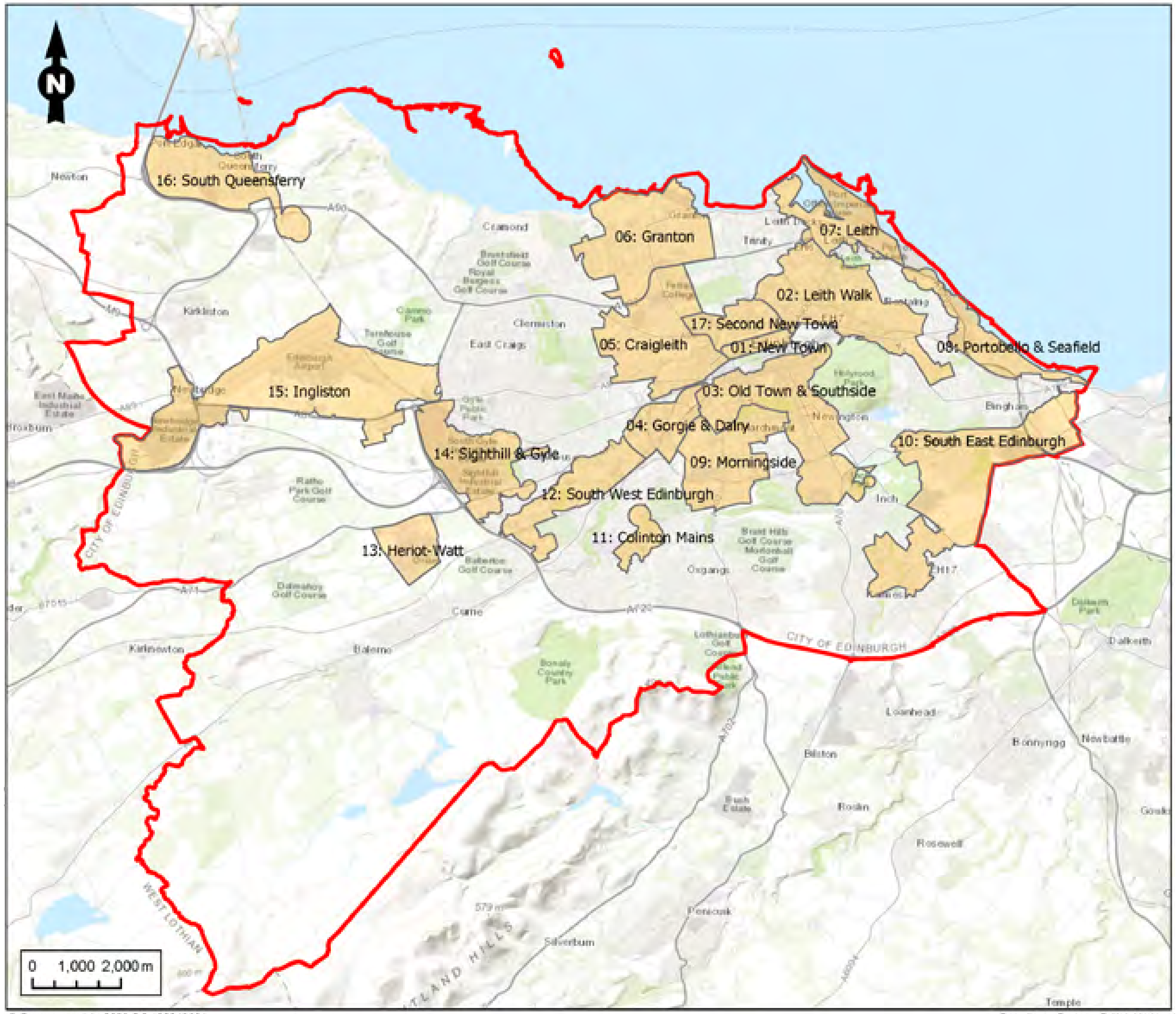
- properties, including tall buildings, that struggle to generate enough zero-carbon energy on site to meet their heating and hot water needs.
- historic properties where opportunities are limited to improve fabric efficiency and/or employ net zero heating solutions such as air source heat pumps.

The [*Edinburgh Local Heat and Energy Efficiency Strategy (LHEES)*] and accompanying delivery plan provides a long-term strategic framework to reduce greenhouse gas emissions associated with heating our buildings. This includes migrating heating systems away from fossil fuels-based solutions, such as gas boilers, to zero direct emissions solutions such as heat pumps and heat networks. The delivery plan proposes Heat Network Zones representing areas of opportunity for district heating.

If the development site falls partially or wholly within, or adjacent to:

- a planned heat network,
- statutory heat network zone,
- a prospective heat network zone,

the proposals must be designed and constructed to allow for cost-effective connection to a future heat network at a later date.



Coordinate System: British National

Map of prospective heat network zones.