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The Zeroth Energy System

Foreword

Ambient loop technology offers a revolutionary way to deliver energy to residential apartment buildings. When compared to traditional high temperature systems, the lower temperature of an ambient loop allows low-carbon energy sources to be used offering huge sustainability advantages. The plant room required to service an ambient loop is smaller, reducing capital costs and freeing up valuable additional residential or commercial space.

The addition of a Zeroth in-apartment heat pump further amplifies the advantages of specifying ambient loop technology. The Zeroth unit uses the energy in the ambient loop to provide residents with low-carbon hot water and heating. When matched with an Ability by Dimplex Fan Coil Unit (FCU) the Zeroth Energy System can deliver comfort cooling to provide residents with full control over their thermal comfort all year round.

This guide explains the principles behind ambient loop technology and the benefits of linking the loop to the Zeroth in-apartment heat pump. It will show that the Zeroth Energy System is compatible with a wide range of energy sources including modern low-carbon technologies, district heat networks (DHN) and low-carbon energy networks.

Contents

Introduction

Ambient loops have already been, and continue to be, specified to meet current building regulations and can help achieve compliance with regional requirements such as the London Plan, which require heating and cooling systems to be increasingly energy efficient.

The introduction of the Future Homes and Buildings Standard (FHBS), with its highly anticipated dynamic modelling and simulation system (Home Energy Modelling or HEM), is expected to be due in 2025. The FHBS will likely represent a significant change in regulations and will add to the challenges facing specifiers as it:

- Aims to end the reliance on the use of fossil fuels as an energy source
- Prioritises low-carbon systems to generate heating, hot water and comfort cooling in buildings
- More closely links energy efficiency (Part L), ventilation (Part F) and overheating (Part O) regulations to require a more holistic view to be taken to specification

The Zeroth Energy System incorporates an ambient loop and in-apartment heat pump and provides the flexibility required to help meet both current and future regulatory requirements.

Ambient loop

The low operating temperature of the ambient loop allows it to be connected to a wide variety of energy sources. Unlike high temperature systems, it is compatible with low-carbon energy sources, such as heat pumps, or low-grade heat waste produced from industry. This makes it the perfect match for the type of low-carbon energy sources that offer an alternative to traditional high-heat sources with their associated high-carbon emissions.

The water in a building's distribution pipes serviced by a high temperature system lose more heat than those connected to an ambient loop. The ambient loop recovers and redistributes energy around the system helping to maximise its energy efficiency. High temperature systems supply heat at a set temperature and have no route to recover heat, so cannot reduce their energy output or carbon emissions to match usage requirements.

Zeroth in-apartment heat pump

In-apartment heat pumps are a renewable technology that uses the low-grade energy of the ambient loop to provide hot water and heating to each apartment. Compact in size they can work with a variety of emitters to provide heat and comfort cooling to the apartment.

The Zeroth Energy System

Combines the benefits of the ambient loop, heat pumps, emitters and controls to offer a complete low-carbon system for providing hot water, heating and comfort cooling to residential apartments and mixed-use developments.

Ambient loop

- Can be linked to any heat source
- Helps to address overheating due to minimal internal distribution heat loss
- Recovers and redistributes energy to maximise efficiency of heating and cooling throughout the building

Zeroth in-apartment heat pump

- Gives design freedom to choose any emitter
- Has a compact design to maximise internal living space
- Is designed for simplified installation on-site and can be supplied within prefabricated utility cupboards

The Zeroth Energy System

- Provides an energy efficient, low-carbon heating, hot water and comfort cooling solution
- Helps to address overheating in multi-occupancy buildings
- Delivers improved indoor air quality in conjunction with MVHR
- Maximises energy sharing opportunities within the building and within the E.ON Ectogrid™
- Can be integrated with customised smart controls designed to optimise system performance and thermal comfort for residents when specified with other technologies such as Ability Fan Coil Units
- Is compatible with most in-apartment control options to ensure resident can control hot water and space heating

What is an ambient loop and how does the Zeroth Energy System work?

In-apartment heat pumps are linked to an ambient loop. The central plant needed to supply the energy for the loop is much smaller than required for high temperature systems, reducing the size of the plant room. The in-apartment heat pumps take energy from the ambient loop and provide hot water and heating with zero-emissions at the point of use.

Ambient loop

The communal ambient loop of the Zeroth Energy system operates at a low-temperature of just 25°C and this helps to:

- Reduce the size and capital cost of the plant room needed when compared to high temperature systems. This increases the usable residential or commercial space available within the building.
- Minimise distribution heat losses to improve system efficiency and reduce the risk of overheating.
- Recover and redistribute energy around the system helping to reduce energy waste and maximise energy efficiency.

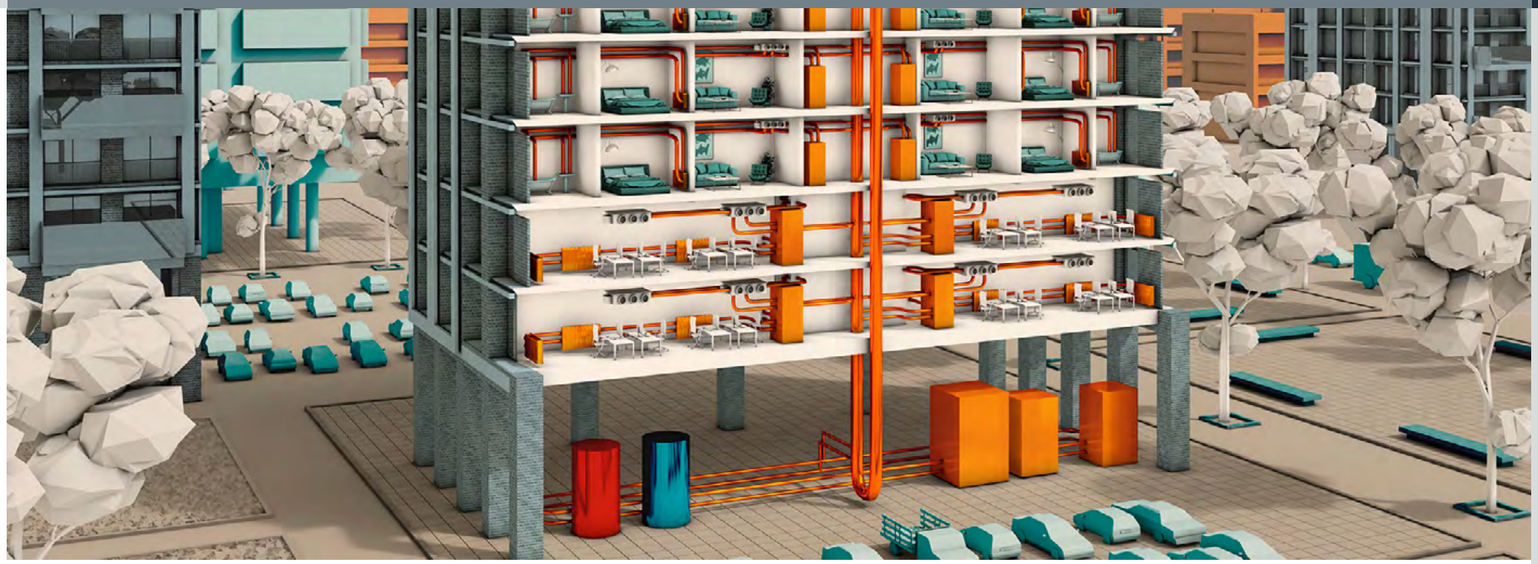
The Zeroth in-apartment heat pump unit

Each apartment is equipped with a compact Zeroth in-apartment heat pump unit connected to the ambient loop. The Zeroth unit efficiently delivers domestic hot water, space heating and optional comfort cooling with zero emissions at the point of use. Domestic hot water is stored in an unvented, integrated cylinder that sits below the heat pump module.

The Zeroth Energy System comes in two variants:

- Domestic hot water and space heating
- Domestic hot water, space heating and comfort cooling

The Zeroth Energy System supports a range of emitters, including wet radiators, underfloor heating and fan coil units, catering to diverse project and aesthetic requirements.



Flexibility of the Zeroth Energy System

In-apartment

- Zeroth in-apartment heat pump
- Choice of heating and comfort cooling technologies
- Smart electricity meter
- Ventilation technologies

Emitters

- Fan coil units
- Underfloor heating
- Wet radiator systems
- Fan-assisted radiators

Controls

- Zeroth heat pump on-board control
- Range of in-apartment thermostats
- BMS integration

Plant / distribution

- Ambient water loop
- Reduced central plant room size
- Plant heat pump or DHC connection

The Zeroth in-apartment heat pump

Don't be fooled by the compact size of the Zeroth in-apartment heat pump unit – although it can fit inside a standard utility cupboard, this versatile and unassuming low-carbon powerhouse makes light work of delivering hot water, heating and comfort cooling to the whole apartment. Its whisper quiet operation is down to the advanced materials and meticulous design used in its creation. Installing the Zeroth in-apartment heat pump unit couldn't be easier, it as it comes pre-wired and pre-plumbed so it doesn't require specialist heat pump installers. It also has a durable low-maintenance design, so residents will hardly know it's there at all.

The Zeroth Energy System is available in the following variations:

- Zeroth Heat Pump: 4 and 6kW for heating and hot water
- Zeroth Heat Pump: 4, 6 and 9kW for heating, hot water and comfort cooling

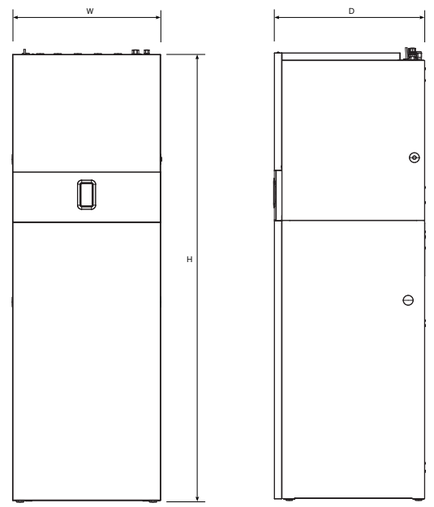
The integrated cylinder is made from stainless steel with a heat pump mounted underneath in a removable module. Also included is a built-in heating system circulation pump and a built-in PIC valve for the energy loop. The cylinder is engineered for longevity and does not require a sacrificial anode, reducing maintenance requirements and maximising service life.

The outer casing is made from painted white steel formed around a rigid frame, with adjustable feet. The end user controls are mounted flush on the front and all pipework and cable entries are on the top of the unit, except for a drain hose (connected at the back) and the discharge, which can be piped left or right through the knockout.

A built-in and independently wired 2 kW immersion heater within the hot water cylinder provides emergency backup, ensuring a continuous supply of hot water even during maintenance or repairs.

Overview of dimensions, output, COP and sound performance

Model	4 kW		6 kW		9 kW
Model number	**ZHP4H-180**	**ZHP4C-180**	**ZHP6H-180**	**ZHP6C-180**	**ZHP9C-180**
Services	Heating and hot water	Heating, hot water & comfort cooling	Heating and hot water	Heating, hot water & comfort cooling	Heating, hot water & comfort cooling
Dimensions (W x D x H) mm	550 × 560 × 2000				
Output kW @ flowrate S25 / W35	4.0	4.0	6.4	6.4	9.3
COP	9.3	9.3	8.4	8.4	8.4
Sound performance dB(A)	34	34	36	36	41



300% **Overall system efficiency**

90% **Communal heating reduction***

5 : 1 **Space cooling efficiency**

*When comparing the Zeroth Energy System with standard CHP solutions

For more information on this technology, scan the QR code.

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What are the energy sources for the Zeroth Energy System?

The smart and versatile Zeroth Energy System is happy to work with all available energy sources for apartments on the market.

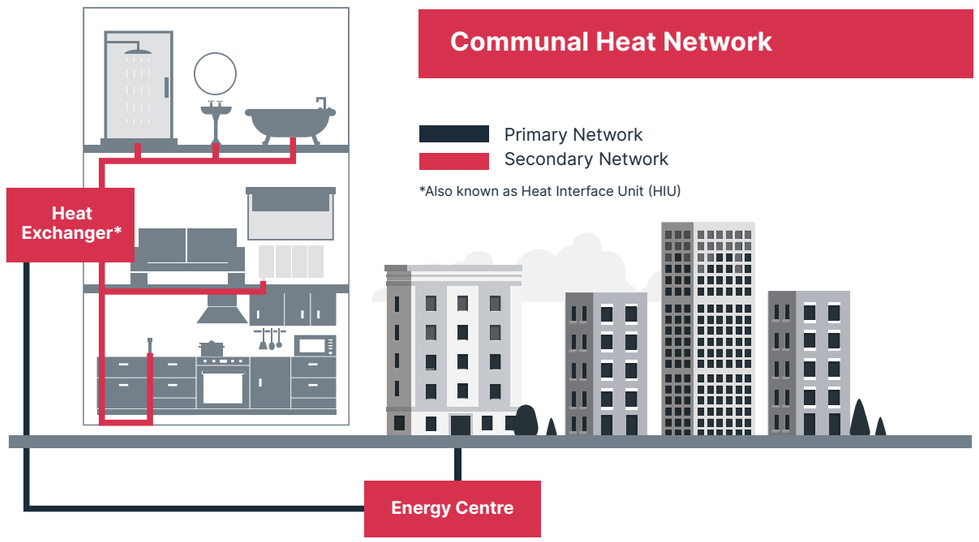
Heat pumps

The in-apartment heat pump can use heat generated from all types of renewable heat pump technology:

- Air Source Heat Pump (ASHP)
- Ground Source Heat Pump (GSHP)
- Water Source Heat Pump (WSHP)

3rd and 4th Generation District Heat Networks

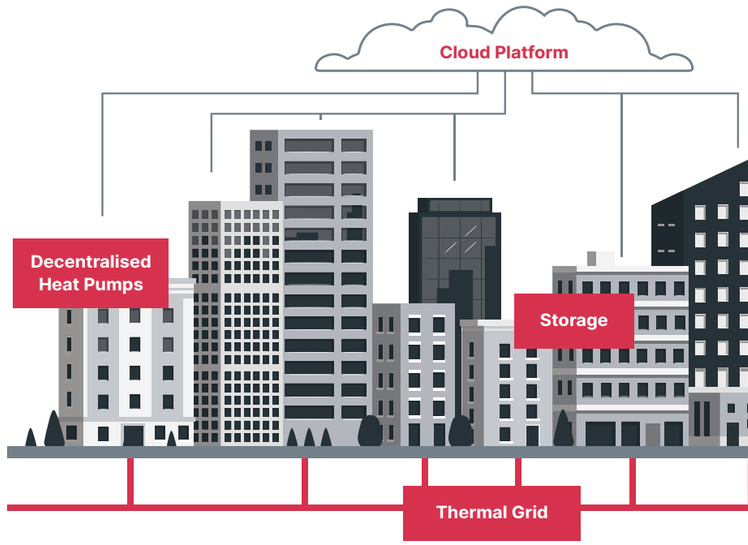
3rd Generation District Heat Networks (3GDHNs) are usually powered to some extent by fossil fuels, whereas more recent 4th Generation (4GDHNs) are likely to use large-scale heat pumps to supply their energy needs. Either can be connected through a heat exchanger in the building's plant room to the Zeroth Energy System's ambient loop.



Low-carbon energy network

A low-carbon energy network solution, such as the E.ON Ectogrid™, adapts to the conditions of the local environment to make the most of the surrounding energy available. New energy is only added into the system when all available energy has been fully shared between buildings or harnessed from available energy sources in the vicinity.

Locally available natural energy sources can be harnessed by heat pumps from the air, water or ground. Waste heat can be also used from sources like local industries and data centres.



Through decentralised heat pumps in each building connected to each other on a common low-temperature grid, excess energy is recovered and distributed between buildings, minimising waste and maximising efficiency.

As energy saving and high efficiency are ingrained in the DNA of the Zeroth Energy System it is the perfect partner for connecting to a low-carbon energy network. The energy network can redistribute energy between buildings to match demand in the same way that Zeroth balances out its ambient loop when heating and cooling demands vary throughout an apartment building. In this way the two systems can work together to minimise energy waste and maximise overall system efficiency.

Cooling

The versatility of the Zeroth Energy System really shines when it comes to its ability to provide comfort cooling. In those heady summer days when the sun shines, residents can use the Ability Fan Coil Units of the Zeroth Energy System to keep their cool.

Comfort cooling

The Zeroth Energy System can provide comfort cooling through a two-pipe system, with only the addition of a reverse cycle valve and relevant emitters. Both heating and cooling can be provided in one system adding a price premium to apartments at a fraction of the cost of a separate cooling system.

Comfort cooling using an ambient loop re-uses the heat generated by the process of cooling within the system. It does not exhaust excess heat to the outside of the building like traditional air-conditioning systems. In this way, the Zeroth Energy System does not add to the urban heat island effect that creates a warm microclimate in densely populated areas.

Increased energy efficiency

As heat pumps transfer energy to work, they effectively produce waste cooling energy when in heating mode and waste heat energy when in cooling mode. The Zeroth Energy System's intelligent use of the storage capacity of hot water cylinders, as well as the energy sharing properties of the ambient loop, ensure the energy demand of the building is balanced. This reduces energy drawn from the main plant and maximises the efficiency of the Zeroth Energy System.

As well as lowering energy bills for residents, this increased energy efficiency reduces the operational carbon emissions of the apartment building and improves its sustainability.

Mitigation against overheating

The lower temperature of the ambient loop when compared to higher temperature heating systems results in lower heat distribution losses. This helps to reduce the risk of overheating whilst improving occupant comfort for all the residents of the apartment.

Heat losses can make a traditional high heat energy network scheme up to 90% less efficient than ambient loop solutions.

Ventilation

Zeroth and mechanical ventilation

A Mechanical Ventilation with Heat Recovery (MVHR) system uses heat from extracted stale air to warm incoming air for a comfortable indoor environment and increased energy efficiency. MVHRs work with the Zeroth Energy System to provide balanced and controlled whole-apartment ventilation and helps meet the ventilation requirements (Part F) of the building regulations. When MVHR is specified alongside comfort cooling from the Zeroth Energy System it provides an excellent way to ensure that residents can enjoy full control of their indoor environment all year round.

Emitter options for heating and cooling

The Zeroth Energy System can work with a variety of emitters and their selection will depend on individual project requirements and whether comfort cooling is required.

Type of emitter	Use
Underfloor heating	Heating only
Hydronic radiators	Heating only
Fan coil units	Heating and comfort cooling
Fan assisted radiators	Heating and comfort cooling

Emitters for heating and comfort cooling

Fan coil units

Fan coil units (FCUs) are commonly used in projects requiring both heating and cooling but can work alongside underfloor heating. The FCU's system design can be customised to fit specific project needs, including managing overheating to comply with Part O regulations.

When the Zeroth Energy System is used with Ability FCUs, apartment controls can be fully customised to optimise indoor thermal comfort throughout the apartment.

Fan coil units from Ability by Dimplex

Fan coil units (FCUs)

EVO range of fan coil units

Hydronic fan coil units are an energy efficient solution for heating and cooling spaces. The ability to choose from a wide range of universally available components, coupled with a reduced need for specialist installation and servicing engineers adds to the benefits.

Matrix Multiroom fan coil units

Patented Multiroom system allows each emitter to control individual temperatures in each zone or room. The system can combine the use of FCUs with other heat emitters such as underfloor heating and towel rails for a solution that works best for the needs of each project.

EVO

The EVO range consists of the core products within the Ability portfolio, offering quiet, highly efficient and cost-effective solutions.

Matrix Multiroom

The patent-protected design builds on the success of the EVO range, introducing a number of innovative features.

For more information on this technology, scan the QR code.

FCUs with heat pump ready coils

Specifiers are moving towards heat pumps as the primary source of low-temperature hot water in hydronic heating systems. Ability coils are designed to optimise heat output at the lower flow temperatures associated with heat pumps, without any negative impact on cooling. This means the number of FCUs required can be reduced with a proportionate reduction in their carbon footprint.

Fan assisted radiators

Unlike standard wet radiators, these, as the name suggests, have fan assistance which is a good way to distribute heat throughout the room. Equally when the water in the radiators has been cooled, cooler air can be blown by the fan assistance system to provide comfort cooling.

Emitter options for heating and cooling

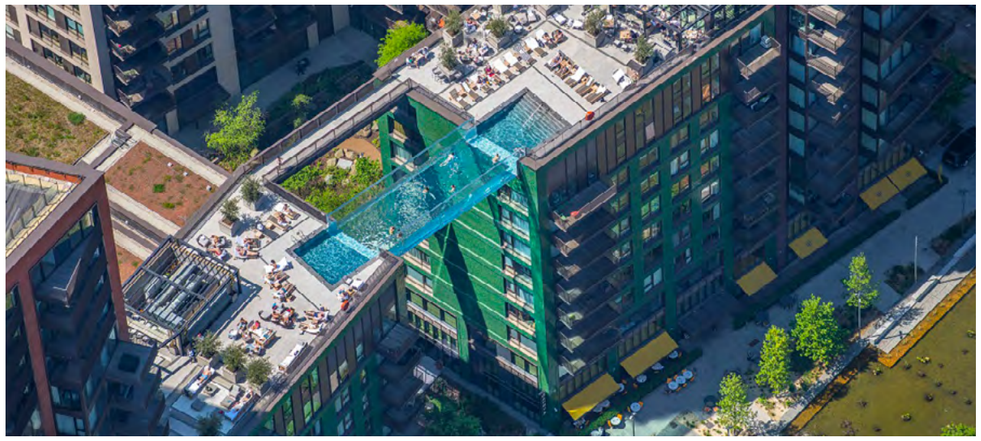
Emitters for heating only

Underfloor heating

The heat supplied by the apartment water-to-water heat pump is at a lower temperature than if it were to be supplied by a fossil fuel boiler. Therefore, it is better to have an emitter with a larger surface area such as underfloor heating. The warm water is pumped through the pipes installed under the floor and heats up the whole floor area to provide an even distribution of heat to raise the indoor temperature to the required level.

Hydronic radiators

Hydronic radiators can also be used with the Zeroth Energy System. There is a wide choice available, including low-temperature radiators that provide more heat output than standard radiators of the same size. The exact choice of radiators will be project specific and they will be chosen to ensure that the heated water from the in-apartment heat pump will supply the required heat load for the apartment.



The Zeroth Energy System
Ventilation

Xpelair Natural Air MVHR is a highly efficient mechanical ventilation and heat recovery unit that provides balanced and controlled whole-apartment ventilation.

Mechanical Ventilation with Heat Recovery (MVHR)

This system uses heat from extracted stale air to warm incoming air for a comfortable indoor environment and increased efficiency.

Natural Air MVHR 180 / 180 PH

For more information on his technology, scan the QR code.

Controls

The Zeroth Energy System features an intuitive, wall mounted in-apartment control unit. This gives occupiers full control over the thermal requirements of their space heating and access to the features of the hot water system.

The Zeroth Energy System was designed for integration with building management systems, giving the specifier and the client full flexibility of design and not restricting them to a specific brand or manufacturer.

ATMO fan coil controls

Ultimate control system for controlling thermal comfort and hot water provision, fully compatible with the Zeroth Energy System.

- App control of individual zone temperatures and schedules
- Step-by-step installation wizard to configure your system
- Remote access for temperature control and manual override
- Primary user can configure zones and scheduling, secondary users can adjust current operation and temperatures
- Boost modes for temperature control
- Up to 8 individual zones

ATMO can be configured to include additional emitters if these are specified to enable simpler control over multiple technologies.

Case studies

Harbour Lofts utilises ambient temperature loop

The Zeroth Energy System with an ASHP as a central plant provides a low-carbon heating and hot water solution for a boutique regeneration project.

READ MORE HERE

Embassy Gardens utilises 2,042 fan coil units

In total 2,042 units of EVO, Matrix and Matrix Multiroom fan coils were specified throughout the flagship development at London's South Bank.

READ MORE HERE

Church Road and the Zeroth Energy System

The development by Galliard Homes comprises of 38 contemporary one-, two- and three-bedroom apartments and two luxurious 3-bedroom townhouses. It is one of the first in the UK to showcase the benefits of the cutting edge Zeroth Energy System.

READ MORE HERE

Projects

Deptford Landings, Deptford

Gloster installed 254 Zeroth in-apartment heat pump units on behalf of Lendlease.

Paradise Fields & Randalls Rise, Hemel Hempstead

Bugler Developments delivered the two projects for Dacorum Borough Council with 56 and 30 Zeroth in-apartment heat pump units installed respectively.

Manor Road, Canning Town

The development by Morgan Sindall features 355 Zeroth in-apartment heat pump units.

Silvertown Quays, Newham

The multistage Lendlease development starts with 106 affordable homes with Zeroth in-apartment heat pump units planned for delivery in autumn 2025.

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0344 879 3586

pre-sales@glendimplex.com

Dimplex, Millbrook House, Grange Drive, Hedge End
Southampton, Hampshire, United Kingdom SO30 2DF