Taylor Wimpey plc

Zero carbon ready homes trial

Investor and analyst site visit

June 2023

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Meet the team

Stephen Andrew

Group Technical Director

Richard Kinloch

Head of Research & Technical Innovation

Nick Wright

Manufacturing and Supply Chain Director

James Lidgate

Managing Director, TW London

Dave Hamer

Senior Site Manager

Agenda

- Arrival and refreshments
- Presentations
- Q&A
- Plot tours
- Wrap up and refreshments
- Transfer to station

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Approach to Future Homes and Net Zero

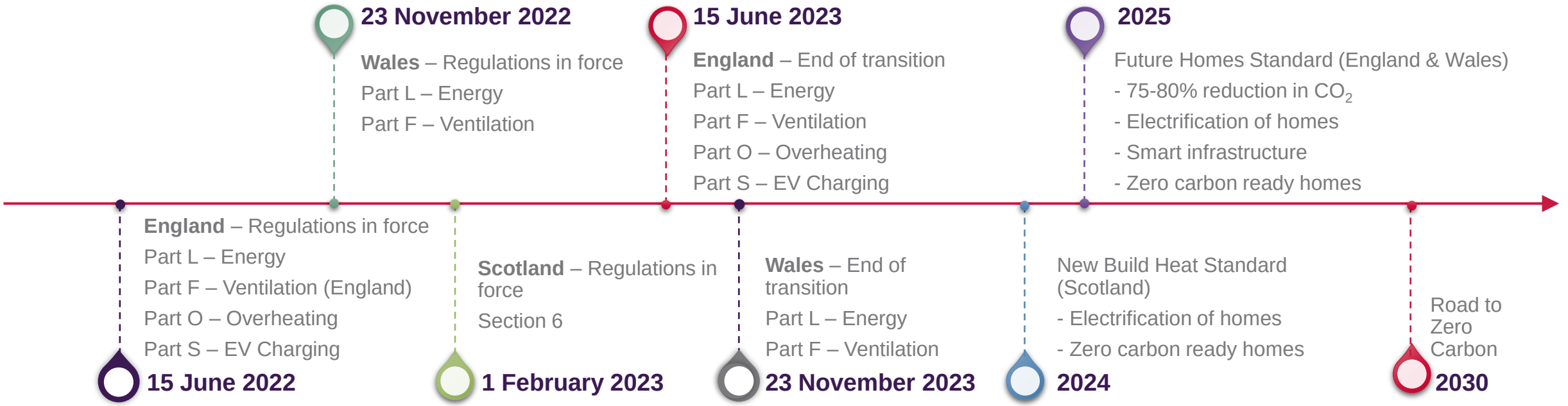
Stephen Andrew
Group Technical Director

Net zero ready

- 40% of the UK's carbon emissions come from the built environment, with the construction sector a major contributor
- In early 2023, we published our Net Zero Transition Plan and announced our commitment to reach net zero emissions by 2045 across our value chain
- In 2025, the Future Homes Standard will require a 75-80% reduction in carbon emissions from new homes and bans the use of fossil fuels
- Collaborating with our supply chain and subcontractors to identify materials, products and methods of working which produce fewer emissions, our existing skill base are able to install and maintain, and deliver the best experience for our customers
- Our trial homes will provide practical and scalable solutions to address industry challenges that deliver high-quality zero carbon ready homes

Holistic approach to net zero carbon

Timeline of new regulations



Other Anticipated Regulatory changes – timing currently uncertain

Part M – Access to and use of buildings
Part B & Building Safety Regulator
Expect Consultations on:
Part K – Protection from falling
Part E – Sound
Part G – Water usage & capacity
Building Safety Bill
Future Homes Standard consultation due 2023

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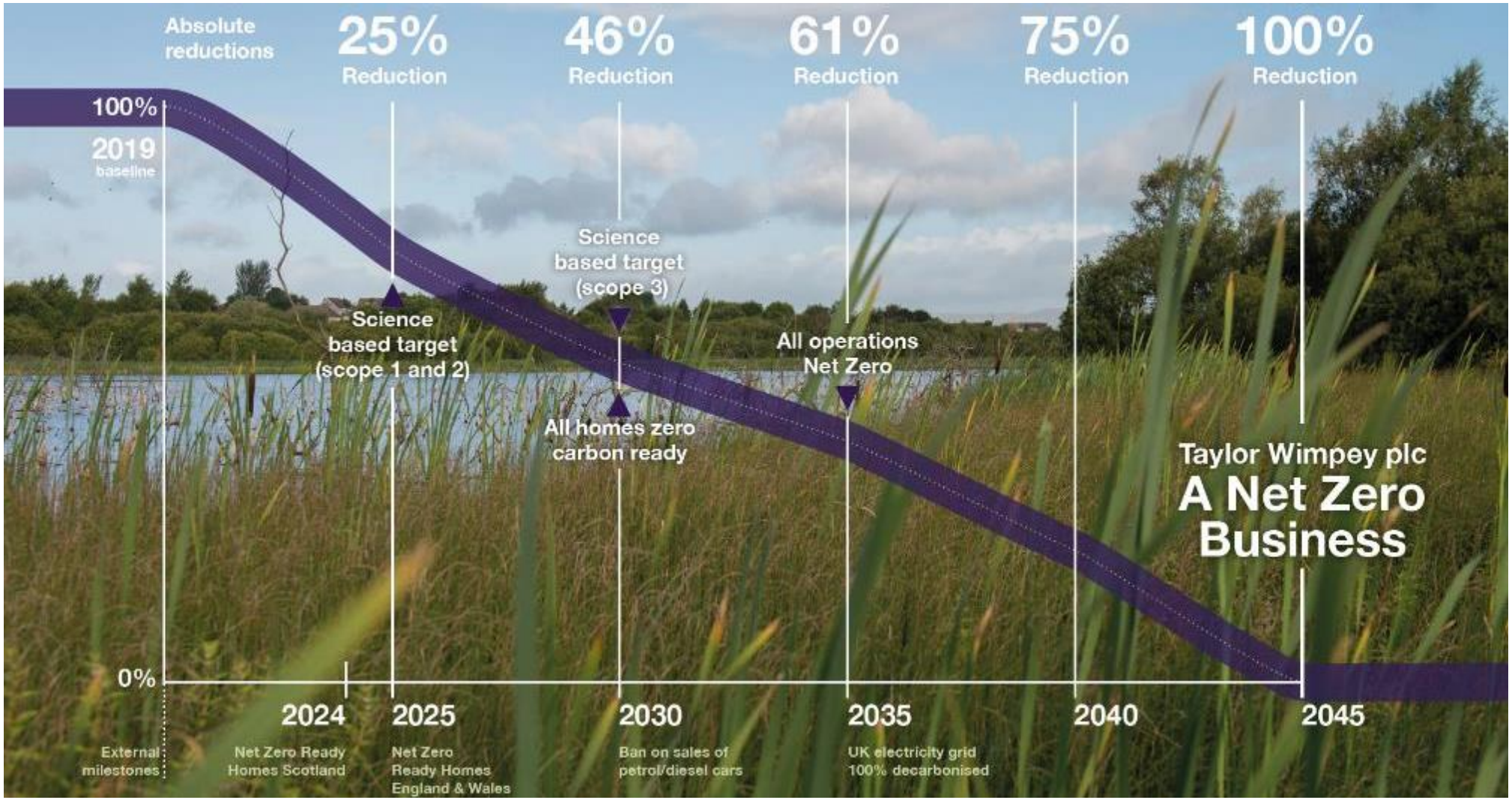
Sustainability: our journey to net zero



Overview: Trialling our homes of the future

What we are doing

- First trial of its kind testing multi-specification homes with low carbon technologies across five plots on a live development site
- We've challenged ourselves and worked closely with our supply chain partners and engineers to design homes with innovative technologies which are customer-focused and deliverable

Our approach

- Using in-house design team, site management team and project managed by TW to retain and capture lessons learnt
- We looked outside the UK in relation to technology solutions
- Trial homes designed to be sold and lived in and we will collate customer feedback
- Workshops during the design and implementation with suppliers, design teams, and subcontractors

What the trials will tell us

- Which are cost-effective and deliverable solutions and which are practicable and scalable in the long term
- Qualitative and quantitative data to make informed decisions on how TW can deliver zero carbon ready homes
- Provide feedback to refine and optimise our approach to FHS ensuring our homes remain customer-focused and deliverable

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Site overview

James Lidgate
Managing Director, TW London

Chilton Woods, Sudbury

- TW London purchased the site in January 2021
- The site had outline planning consent for 1,150 homes which will be built over three phases
- 25% affordable homes
- New primary school, community centre, shops, sports pitches and pavilion
- Community woodlands
- Chilton Woods was selected from a number of potential locations for the FHS trials
  - Large site with a range of house types and sizes
  - Plot situated together in a cul-de-sac
  - Community Heat Hub supplying hot water and heating from phase two

Chilton Woods site plan

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Overview of trial homes

Richard Kinloch
Head of Research & Technical Innovation

Overview of trial homes

- The goal is to find solutions to enable Taylor Wimpey to build high-quality, zero carbon ready homes that our customers will enjoy living in
- Five homes testing different combinations of building methodology, fabric options and technology solutions
- Challenged ourselves to create multi-specification ‘all electric’ homes that showcase different approaches to deliver zero carbon ready homes
- The trial will understand how these technologies interact, impact and influence each other through the life cycle of the trial

Concept → Discovery → Design → Build → Measurement → Customer Experience

Overview of trial homes

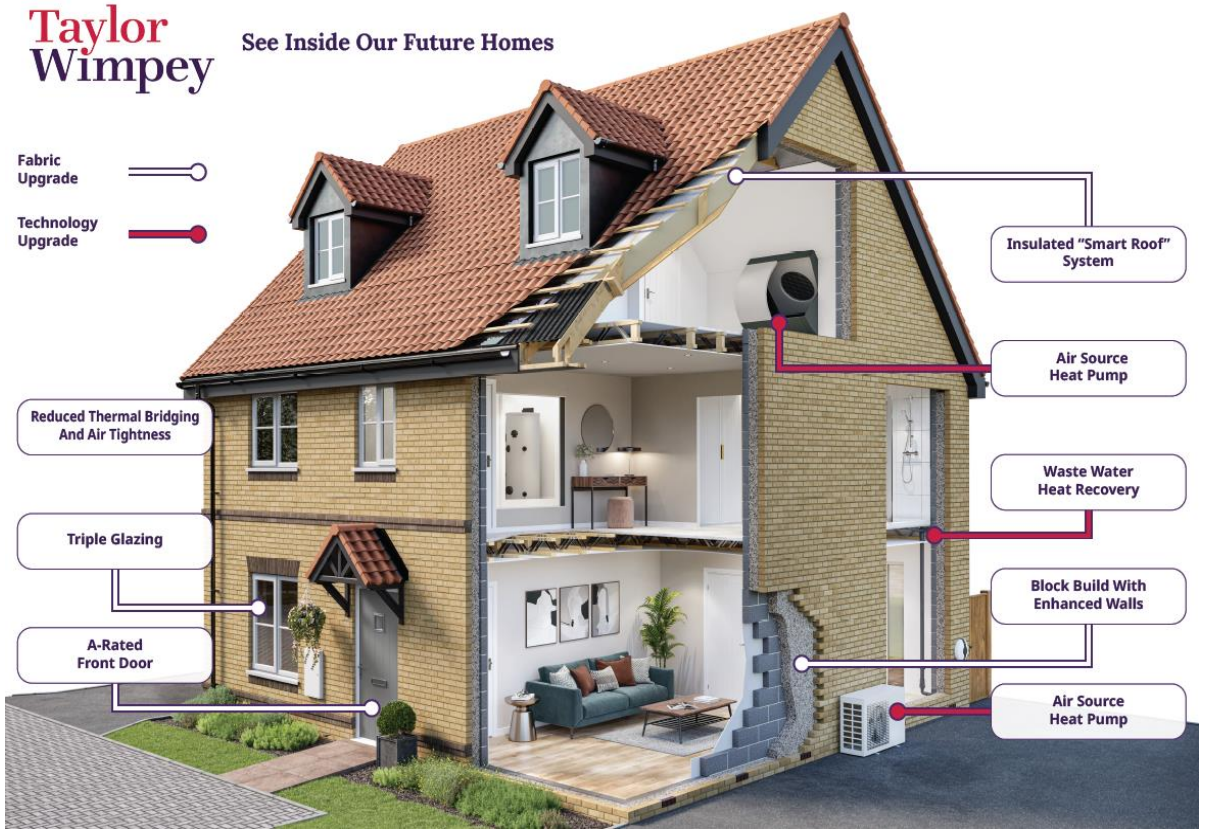
- Fabric First Approach: The first point to address when building an energy efficient home is the fabric of the building itself - the walls, doors, windows, roof and floors - sometimes referred to as the building envelope

- The core fabric will remain in place for the lifespan of the building and most likely outlast any technologies

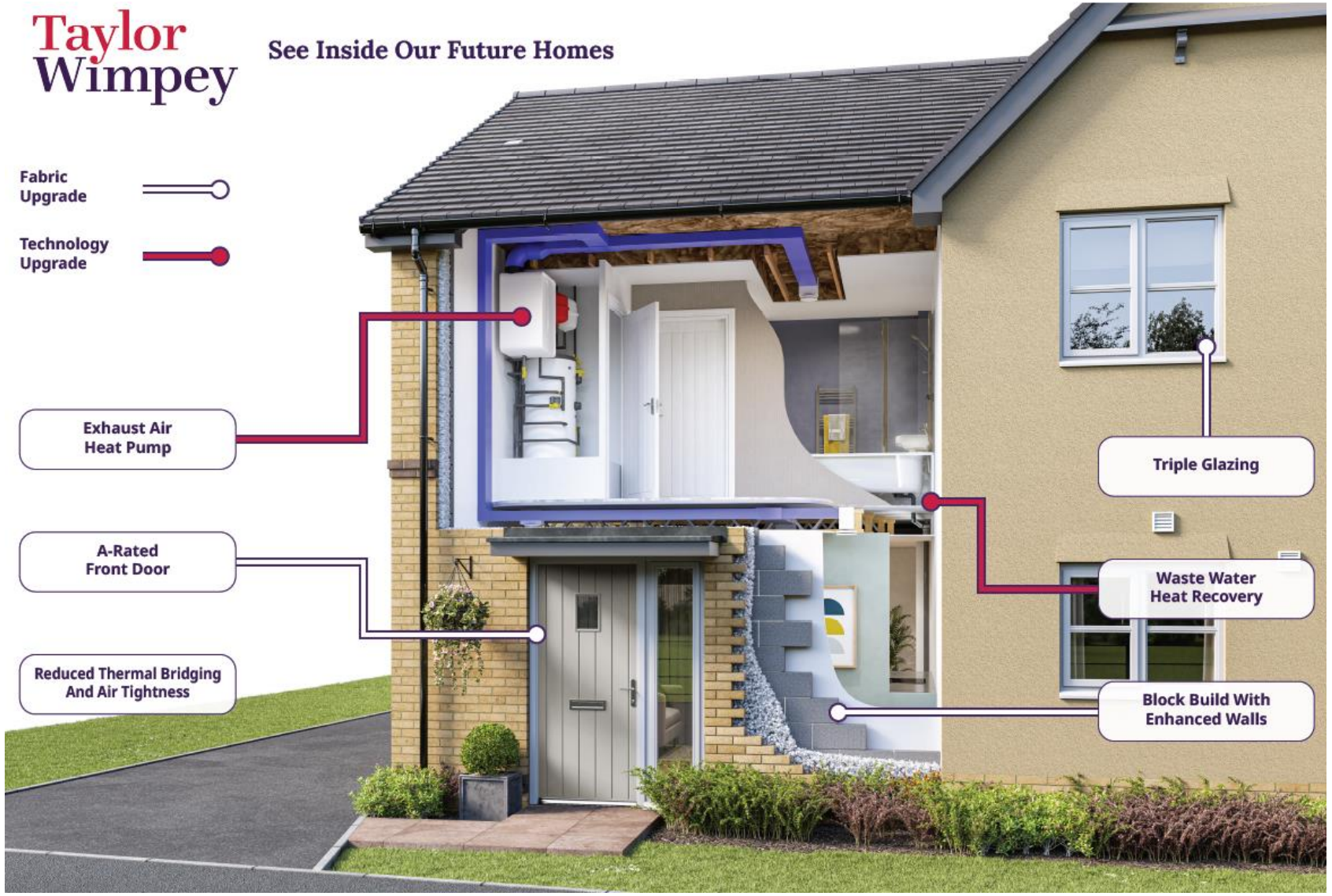
- Selecting the materials we use, and paying attention to the design of thermal bridging junctions, combined with lower air tightness levels, helps us reduce the demand for space heating in our homes, in turn reducing the energy they use

Plot 151 - Trusdale

Plot 152 and 153 – Garrton



Plot 154 - Ashenford

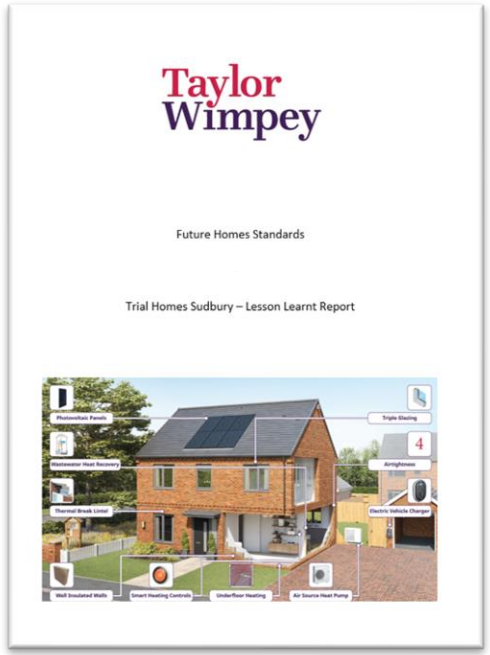


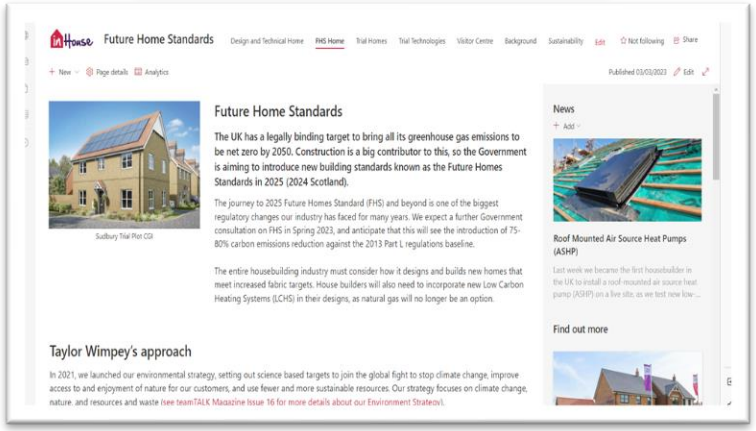
Plot 155 - Easedale

Approach to nature

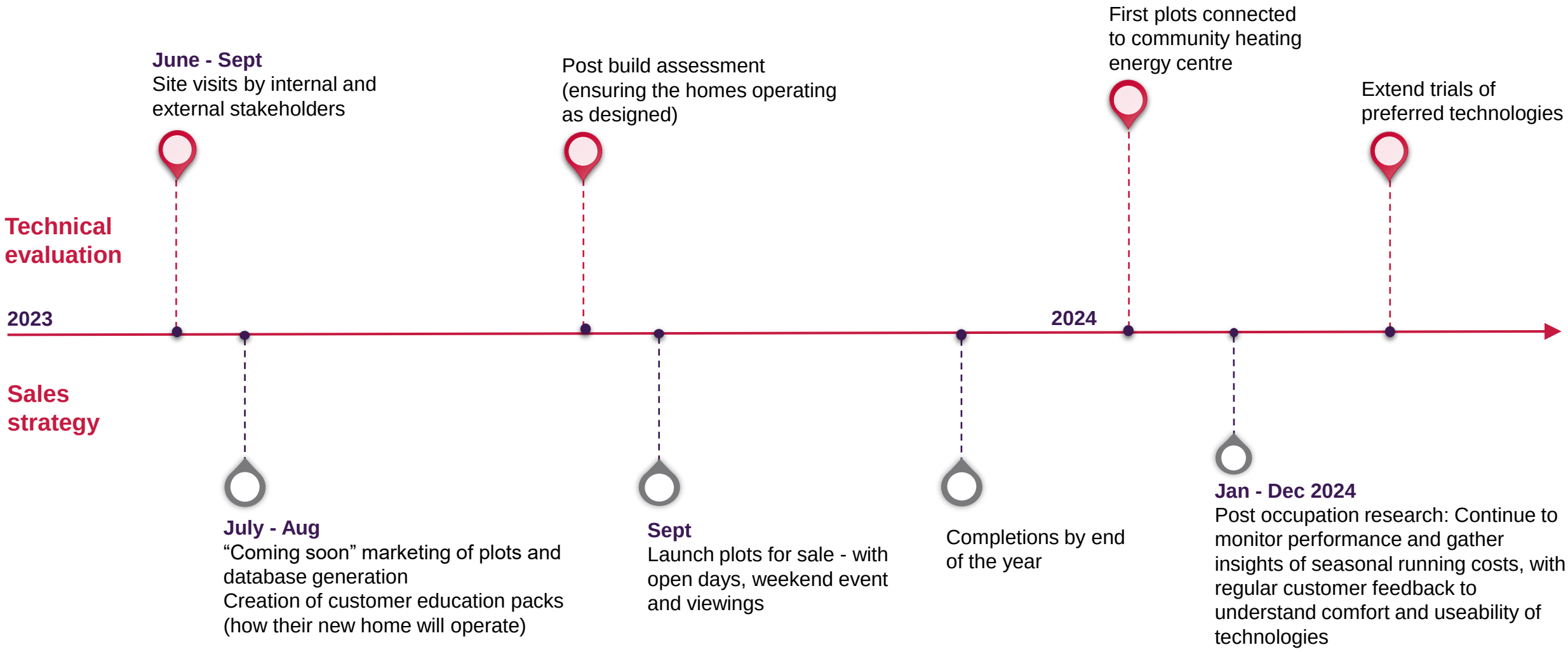
Lessons learned and knowledge sharing with the wider business

- We have produced a comprehensive document detailing the lessons learnt through the full development cycle
- Plot by plot break down – including a record of commissioning for each heating and hot water system
- All functions including our consultants contributed to creating this document
- Capturing of lessons learnt will continue through our measuring and verification process and the gathering of feedback from the home owners
- Knowledge sharing through workshops, TW intranet and survey feedback from stakeholder visits to Sudbury



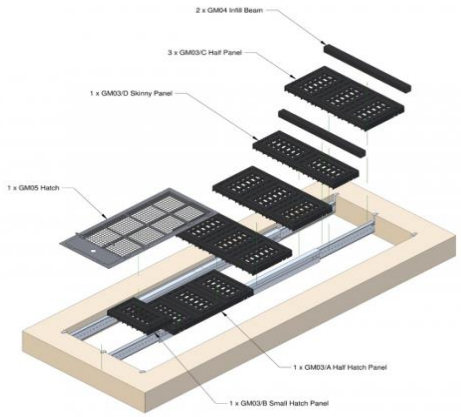


Timeline, sales strategy and technical evaluation next steps



Other R&D workstreams

Through functional work, we are continuously trialing and delivering solutions to simplify, standardise and innovate



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Supply chain considerations and strategy

Nick Wright
Manufacturing and Supply Chain Director

Key supply chain considerations

- Availability of materials and technologies
  - We are working now to understand potential supply bottlenecks. For instance, currently the UK makes up 1% of the worldwide ASHP market with 70% of UK required ASHPs being imported
- Distribution
  - The technologies we are assessing are globally available, however, not widely manufactured in the UK, so distribution may be the greater challenge
  - Firm supplier commitment does require Government to produce timescales prior to building inventories and investing in new products
- Installation
  - Heat Pump Association estimates that >30k installers will be required by 2029
  - Currently there are only 1,134 companies registered with accreditation
  - However, there are more than 100,000 Gas Safe boiler installers in the UK

Supply chain strategy

- The Future Homes Standard (FHS) will bring major changes in the way the industry operates
- Collaboration with the supply chain is key in ensuring the availability of the materials and technologies (not just ASHPs)
- We are collaborating with the supply chain via the Future Homes Hub, a trade body working to address the challenges faced by FHS
- We are also talking directly to our suppliers and have collaborated with our supply chain on these trials which have been a major part in determining the course we will take

Collaborating with our supply chain


Q
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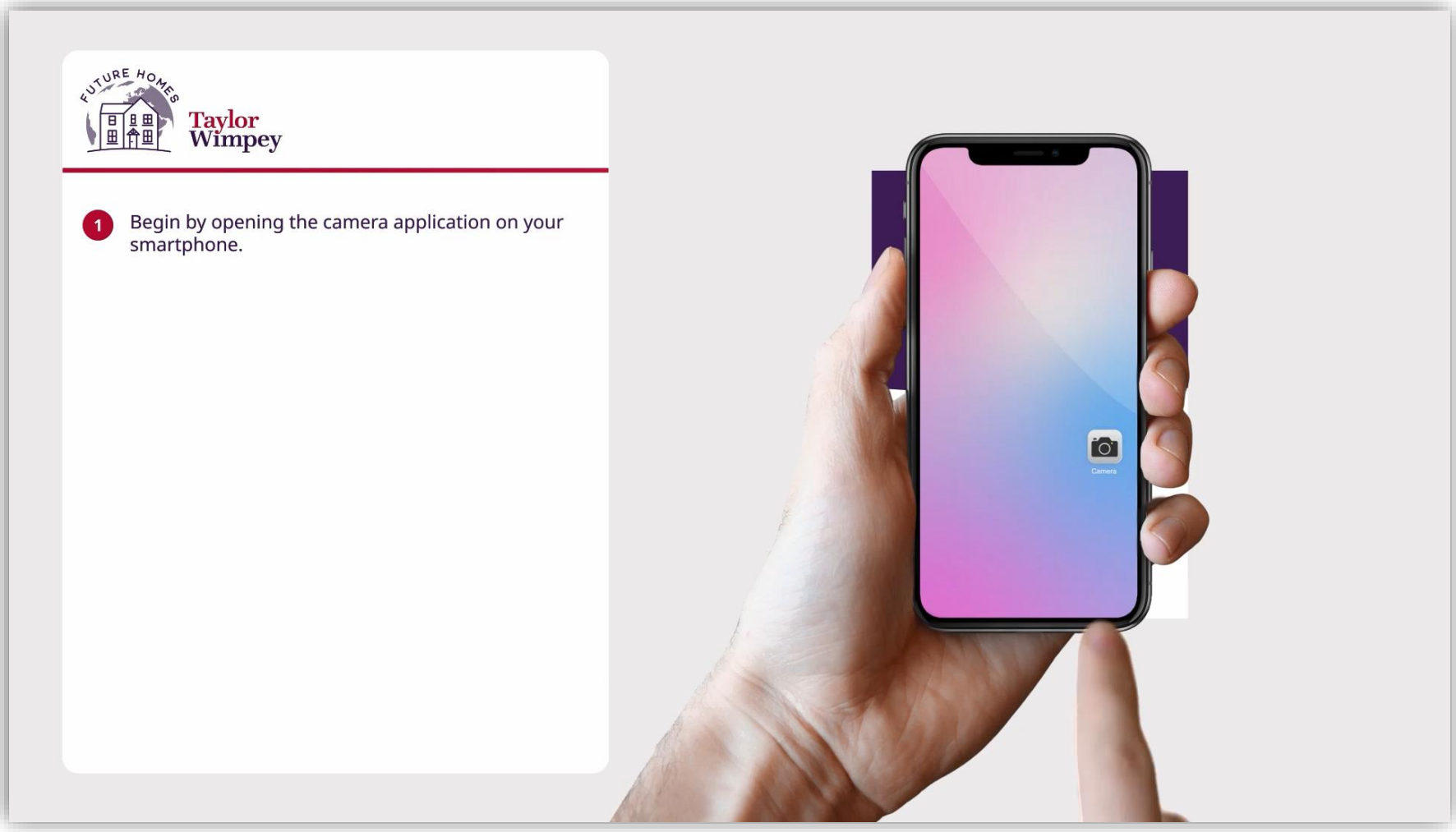
A

Bringing the technology to life



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Trial technologies

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Air Source Heat Pump

- The air source heat pump draws in ambient air from outside, which causes a refrigerant liquid to boil and turn to gas.
- The heat pump then compresses that gas and uses the warmth it creates to heat the home and provide hot water.
- Placing the air source heat pump in the loft, rather than locating it elsewhere either in or outside the home, helps address any noise and vibration concerns, while also preventing the loss of valuable internal space within the home.
- At Sudbury, we are therefore trialling a roof mounted air source heat pump and are the first developer in the UK to do so on a live development.

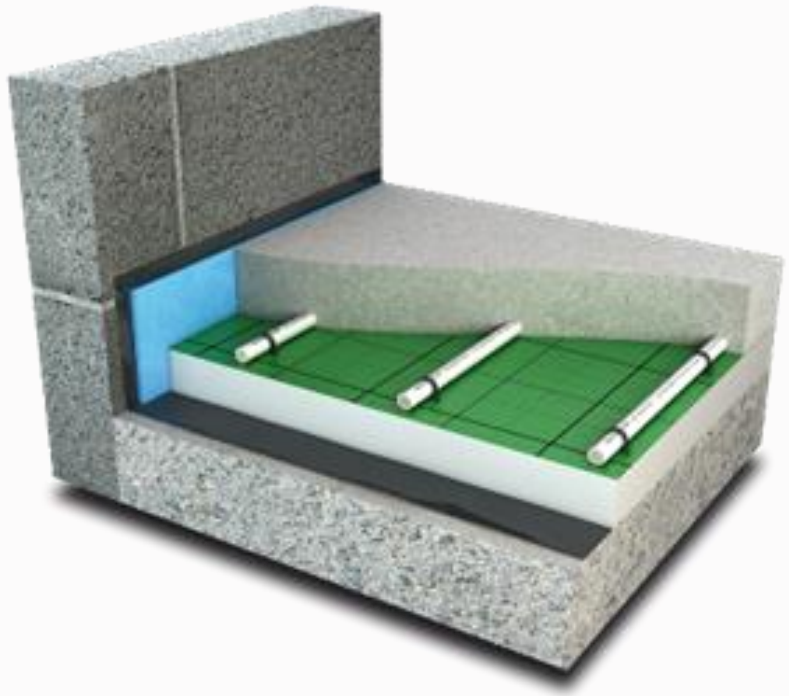
PV Panels

- Sleek solar PV (photo-voltaic) systems are integrated into the roof to provide a renewable source of energy generation.

- Low maintenance and with no moving parts, the solar panels will generate a proportion of the homes electricity requirements, lowering its carbon footprint and reducing its reliance on the grid.

Underfloor Heating (UFH)

- Underfloor heating provides heat evenly and efficiently throughout a room.
- It works by circulating warm water through a network of pipes beneath the floor screed.
- Compared to a traditional central heating system, the entire surface of the floor warms which means that water within the heating system does not need to reach as high a temperature due to the larger surface area being heated.
- As the underfloor heating is completely concealed and there are no radiators, there is more wall space and no limitations to how you can arrange your furniture.



Thermaskirt

- Thermaskirt is an innovative heating system to replace radiators designed to look like a skirting board.
- The hot water pipes run around the perimeter of the room, and a thermally-efficient outer panel extracts heat from the pipes and radiates it into the room, quickly warming the air.
- This low maintenance system is completely concealed, it does not limit the interior design and furniture can be configured as desired.

Battery Storage

- An energy-storage battery enables electric energy from renewables to be stored and then released when power is needed within the home or when electricity is more expensive to buy.
- Batteries work with solar PV panels, capturing and storing the electricity generated during the day when the sun is out so it can be used in the evening or whenever it is needed.
- This stored energy is fed back into the mains consumer unit as and when required, helping to reduce electricity bills.

Infrared Heating

- Infrared heating transfers heat to objects and people directly, rather than heating the air.
- It differs from traditional conduction and convection methods of heating which generally need another material in between to transfer heat to - such as the metal in radiators.
- This is more energy efficient as it heats the person directly rather than the entire room.
- Infrared heating is low maintenance and can be installed on walls, ceilings or floors to provide an alternative space heating option.

Waste Water Heat Recovery for Showers

- Saves energy by recovering and using heat energy from waste water.
- When you shower, you lose valuable heat energy as hot water goes down the drain.
- Waste water heat recovery technology works by transferring latent heat from the waste shower water through a heat exchanger (pipe) system to preheat the incoming mains water.
- This reduces the amount of energy required to heat the mains water, therefore lowering emissions and energy bills.
- This technology has no moving parts and requires no ongoing maintenance.

Mechanical Ventilation Heat Recovery

- Provides fresh filtered air into a building whilst retaining some of the energy that has already been used in heating the building.
- A mechanical ventilation heat recovery system removes the warm air from your bathroom and kitchen and other wet rooms, through a series of ceiling vents and concealed pipes.
- This air then passes through a heat exchanger before it is expelled outside the home.
- The captured heat warms the fresh incoming filtered air from outside and distributes it across the home through ceiling vents.
- The system also filters the air helping to reduce dust and pollen within the home.

Exhaust Air Heat Pump

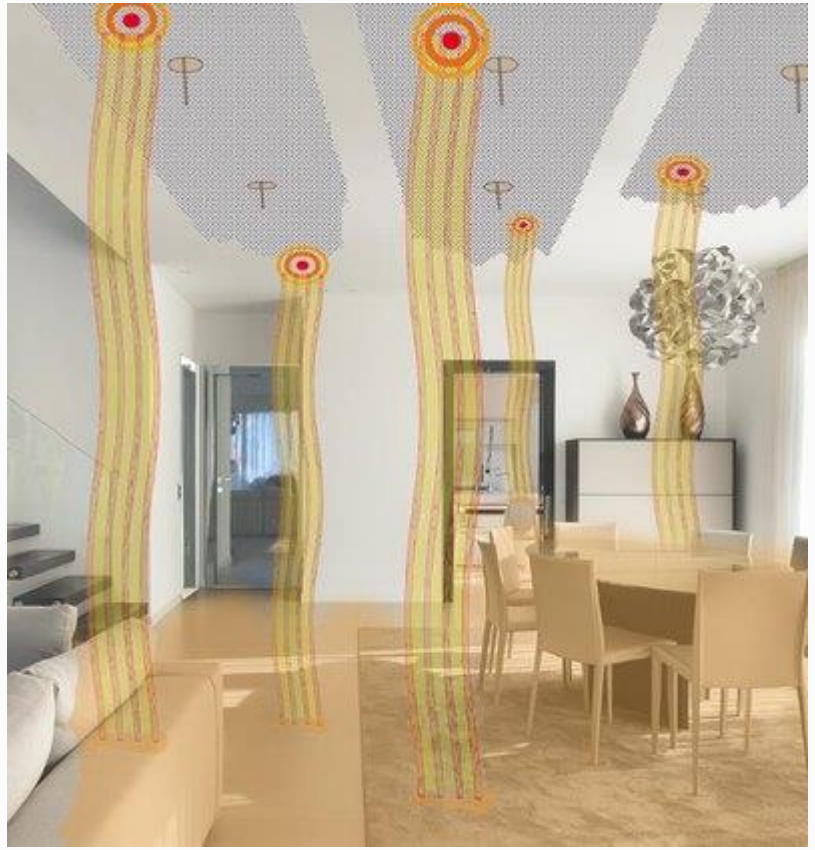
- Absorbs heat from the waste air (or ‘exhaust’ air) leaving a building which is then used to heat the home or water.
- An exhaust air heat pump can combine ventilation, heating and hot water in a single unit.
- It is low maintenance and can be particularly effective in apartments and smaller plots.
- In a similar way to a mechanical ventilation heat recovery system, it uses a system of ceiling vents and concealed pipes to extract warm air from your bathroom and kitchen.
- This warm air is then used to provide space heating and hot water in the same way that an air source heat pump system operates.
- The key difference is that the air comes from inside your home, rather than outside.

Heat Pump Cylinders

- An integral heat pump extracts heat from the outside air, heating up the coils within a closed loop system, which in turn heats up the water in the cylinder.
- A heat pump cylinder can provide hot water very efficiently, working like a traditional air source heat pump by extracting heat from external fresh air via insulated ducting to provide hot water directly into the cylinder.
- They are relatively low maintenance and require an annual check.

Drytec Infrared foil

- Drytec laminated heating panels from Energy Carbon provide infrared heat, gently warming up people and objects with a room from the ceilings with radiant heat. This in turn releases additional heat and the room is kept at a far more comfortable temperature in a more natural way.
- Drytec laminates are fitted between the centres of ceiling joists / roof trusses by electricians without the requirement of special tools or training.



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Plots

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Trial plots – fabric

	The Trusdale Plot 151	The Garrton Plot 152	The Garrton Plot 153	The Ashenford Plot 154	The Easedale Plot 155
Triple glazing	✓	✓	✓	✓	✓
A Rated front door	✓	✓	✓	✓	✓
Timber build with Enhanced walls	✓				
Block build with Enhanced walls		✓	✓	✓	✓

Trial plots – power, heating, and hot water

	The Trusdale Plot 151	The Garrton Plot 152	The Garrton Plot 153	The Ashenford Plot 154	The Easedale Plot 155
Air source heat pump		✓	✓		
Mechanical ventilation			✓		
Exhaust air heat pump				✓	
Battery storage	✓				
Heat pump cylinder					✓
PV panels	✓				✓
Smart cylinders	✓				
Wastewater heat recovery	✓	✓	✓	✓	✓
Underfloor heating			✓		
Thermal skirting			✓		
Electric panel space heating					✓
Infrared Heating	✓				
Smart home energy system	✓				