QVANTUM



The Heat Sharing City

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01 | The urban heat challenge

Britain is entering a more demanding phase of heat decarbonisation. For years, the debate has been framed largely as a question of replacing fossil-fuel heating with low-carbon equipment. That remains necessary. The Future Homes and Buildings Standards will require new homes and non-domestic buildings to be built with low-carbon heating and higher levels of energy efficiency, with the main regulations coming into force in March 2027[1]. But the harder question is now becoming clearer: not only what replaces the boiler, but how low-carbon heat should work in different locations and environments.

That distinction matters because housing is not uniform. In many rural and lower-density developments, individual air source heat pumps can be a practical route away from fossil fuels. These homes often have more external space, fewer acoustic constraints, simpler building forms and more straightforward ownership arrangements. They also have more internal space to house hot water cylinders and thermal energy stores. For these schemes, the transition can look relatively close to a technology substitution: replace the heating source, improve the underlying infrastructure where needed, and electrify demand.

Cities are different. Dense urban developments, apartment blocks, mixed-use neighbourhoods and regeneration sites have less room for simple answers. Space is limited. External units may be difficult to locate. Noise, planning, roof space, façade design, resident disruption and maintenance access all matter more. Grid capacity is often more contested. Heating and cooling demand may overlap across different buildings and uses. In these places, decarbonising heat is not simply a question of installing more equipment; it is a question of designing systems.

The new regulatory context already recognises some of this complexity. The Future Homes and Buildings Standards include updated guidance for buildings connected to new or existing heat networks to demonstrate compliance, alongside guidance on low-carbon heating systems, controls, heat pump installation and building services performance[2]. That is an important signal: heat decarbonisation will not be delivered only home by home. It will also depend on how homes, buildings, networks, controls and the wider energy system work together.

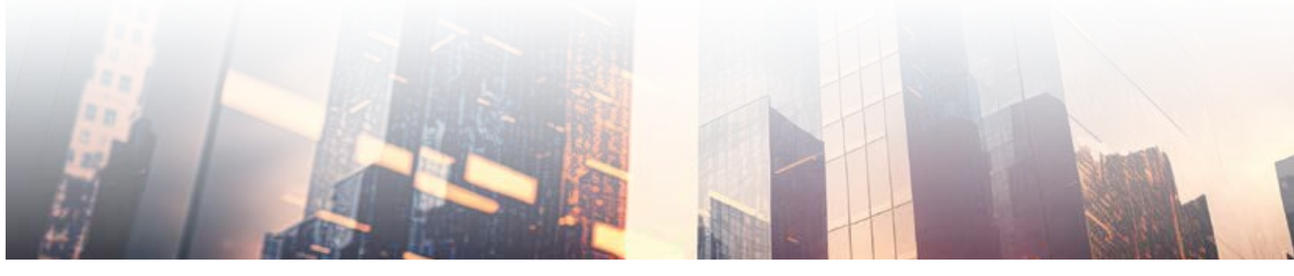
This report focuses on that urban challenge. It argues that the greatest opportunity goes beyond replacing individual gas boilers with individual heat pumps, although that is an important step. Instead, the larger environmental gain comes when heat pumps are connected, controlled and integrated into shared systems that can recover heat, balance demand, link heating and cooling, reduce waste and adapt over time. In cities, where density creates both constraint and opportunity, low-carbon heat needs to be treated as infrastructure rather than as a collection of separate appliances.

The same logic applies to existing buildings as well as new ones. New development will be shaped by the Future Homes Standard, but much of the urban heat challenge sits in buildings that already exist, including estates, apartment blocks, mixed-use sites and buildings close to existing heat networks. Refurbishment and retrofit therefore need to be part of the same conversation. The question is not only how to design better systems from scratch, but how to upgrade, connect and adapt the infrastructure already in place.

[1&2] https://www.gov.uk/government/publications/the-future-homes-and-buildings-standards-building-circular-012026/the-future-homes-and-buildings-standards-building-circular-012026-letter?

Lower-density and rural developments	Dense urban developments
Individual air source heat pumps can often be installed home by home.	A home-by-home approach may be harder to deliver across apartments, high rise buildings and mixed-use schemes.
External space is usually easier to find for equipment.	Roof, façade, balcony and plant space are more constrained and more valuable.
Internal space is usually easier to find for equipment.	Replacing a wall-mounted combi boiler with a full height cylinder is challenging without significant internal space
Acoustic and visual impact may be easier to manage.	Noise, planning, aesthetics and resident proximity can make external units harder to locate.
Ownership and maintenance models are often simpler.	Landlord, leaseholder, operator and resident responsibilities are more complex.
Heating demand is usually the main design issue.	Heating, cooling and hot water demand may overlap across different buildings and uses.
The system can often be designed around individual dwellings.	The better question may be how buildings, networks, storage and controls work together.
Local waste heat opportunities may be limited.	Nearby commercial, retail, transport, data, wastewater or cooling assets may create valuable heat sources.
Grid impact may be easier to assess dwelling by dwelling.	Peak demand, phasing and flexibility need to be considered across the site or district.

The UK cannot decarbonise urban homes at scale by treating every dwelling as an isolated energy problem.



Future-ready homes should not only replace fossil-fuel heating. They should manage comfort.

The premise running through this report is that the UK cannot decarbonise urban homes at scale by treating every dwelling as an isolated energy problem. Cities need connected heat systems that can share energy flows, use waste heat, integrate cooling, manage demand and improve performance over time. That is what makes the urban heat challenge harder. It is also what makes it worth solving.

The implication is not that individual heat pumps are the wrong answer. In many places, they will be the right one. But cities require an additional layer of assessment. Developers, engineers and specifiers need to ask whether heat and coolth (the output of the cooling process) can be shared, recovered, stored or managed across buildings before committing to a system designed around isolated homes.

Why urban heat needs a different approach

The Future Homes and Buildings Standards will require new homes to be built with low-carbon heating and higher levels of energy efficiency from March 2027. That creates a common policy direction, but not a single technical answer. The right approach will depend heavily on density, building form, available space and how heat demand is managed over time.

Industry VIEW

Design networks to grow over time

CHARLOTTE LEE, CEO, HEAT PUMP ASSOCIATION

Urban heat networks do not need to arrive fully formed. They can begin with a strong core of demand, such as a new development, an existing communal system or another anchor load, and then expand as neighbouring buildings and users connect over time.

That makes the early design of the infrastructure particularly important. Networks need to be capable of supporting future connections, while giving developers, operators and customers confidence in how the system will perform and be managed as it grows.

Cooling could strengthen that proposition further. In dense urban housing, particularly apartments, shared systems can provide both heating and cooling, creating an additional benefit for residents and making connection more attractive as summer comfort becomes a greater concern.

The opportunity is therefore not simply to replace one heating technology with another. It is to create urban heat infrastructure that can start with a viable core, expand as demand develops, and provide a broader range of services over time.

The importance of cooling for UK homes

The UK housing debate has traditionally focused on keeping homes warm. That is no longer enough. Hotter summers and more frequent heatwaves mean homes increasingly need to manage cooling as well as heating. The Met Office's State of the UK Climate 2025 report found that 2016 to 2025 was 1.33°C warmer than 1961 to 1990, while days above 30°C and nights above 18°C in Greater London have more than quadrupled over the same comparison period. The Climate Change Committee has also identified overheating in homes as a growing adaptation risk, with active cooling likely to form part of the response alongside passive measures.

For urban heat systems, this changes the brief. Future-ready homes should not only replace fossil-fuel heating. They should manage comfort across seasons, recover useful heat from cooling, and reduce the risk of simply shifting today's heating problem into tomorrow's cooling demand.

This is where modern heat networks become important. In a connected ambient network, a unit providing cooling can reject usable heat into the loop, while a unit providing heating can reject usable cooling. Heating and cooling therefore become linked parts of the same system, rather than separate problems. For urban homes, the task is not only to replace fossil-fuel heating, but to manage comfort across seasons while reducing waste.

02 | From boiler replacement to system-level sustainability

The first task in decarbonising heat is to stop locking fossil-fuel systems into homes that will stand for many decades. This is still not happening consistently. The Climate Change Committee has warned that 71% of new homes still include fossil-fuel boilers, creating avoidable emissions and future retrofit costs for the people who will live in them[3]. Replacing those boilers with heat pumps is therefore a necessary step. It moves domestic heat from combustion to electricity, allowing homes to benefit as the power system becomes cleaner.

But it is only the first step. An individual heat pump can reduce the emissions associated with a single dwelling, but it does not automatically make the surrounding energy system more efficient. It does not, by itself, capture surplus heat from a neighbouring building. It does not balance heating and cooling demand across a mixed-use development. It does not reduce peak demand unless it is controlled intelligently. Nor does it turn a collection of separate homes into a system that can be monitored, maintained and optimised over time.

That distinction matters because the scale of change required is large. The Climate Change Committee's pathway includes around half of UK homes being heated by heat pumps by 2040, compared with around 1% in 2023[4]. If that transition is delivered mainly as a dwelling-by-dwelling equipment swap, the UK will make progress, but it will also miss some of the greater value that electrified heat can offer, particularly in cities. The environmental opportunity is not only to replace the source of heat, but to reduce how much useful energy is wasted in the first place.

Connected heat pump networks take the sustainability case further. When heat pumps are linked through ambient loops, thermal networks, digital controls and shared systems, they can help move energy to where it is needed, recover heat that would otherwise be rejected, link cooling and heating, and smooth demand across time. The difference is the visibility and control needed to treat heat not as a series of isolated transactions inside individual homes, but as a managed flow across buildings.

This is especially important in dense urban developments. A block of flats, a mixed-use scheme or an estate refurbishment may have several different heat profiles operating at once. Some spaces need heating. Others reject heat through cooling. Domestic hot water demand peaks at different times from space heating. Electricity networks may be under pressure at predictable points of the day. A standalone heat pump can serve a home within that system; a connected network can begin to optimise the system itself.

This is where the environmental argument becomes stronger. The move from gas boilers to individual heat pumps reduces dependence on fossil fuels. The move from individual heat pumps to connected heat systems can increase the value of that shift by reducing waste, improving efficiency, enabling flexibility and making better use of local energy flows. For developers, engineers and specifiers, the question should therefore not end with whether heat pumps are used. It should extend to how they are connected, what they can share, and how the wider heat system can adapt over time.

Urban decarbonisation will need both levels of change. Individual homes still need low-carbon heating. But cities also need infrastructure that can make low-carbon heat work harder. In that sense, connected heat pump networks are not a departure from the heat pump transition. They are the next stage of it.

[3] https://www.theccc.org.uk/wp-content/uploads/2025/06/Progress-in-reducing-emissions-2025-report-to-Parliament.pdf

[4] https://www.insidehousing.co.uk/news/new-net-zero-pathway-flags-heat-pump-roll-out-as-priority-90718



Industry VIEW

Designing homes for a low-carbon future

JAMIE BURSNELL, HEAD OF TECHNICAL AND INNOVATION, BELLWAY

For housebuilders, moving away from gas boilers is about much more than replacing one piece of equipment with another. We have to think about how the whole home works, from the heating system and hot water provision through to the space available for equipment, the way people use their homes and, ultimately, what customers expect when they move in.

There isn't necessarily one solution that works across every development, either. What makes sense for a larger detached property might not be practical for a smaller house or an apartment, so it's important that we consider the options early in the design process rather than trying to accommodate a particular technology once everything else has been decided. Heat pumps are becoming an increasingly important part of that thinking, but they bring different considerations around low-temperature heating, hot water storage and installation. We've been looking at how these systems work alongside other elements of the home, including underfloor heating, and how we build the knowledge and skills needed to deliver them consistently.

Cooling is another interesting part of the conversation. As summers become warmer, the ability to offer cooling alongside heating could become a genuine selling point for housebuilders. It's something customers may increasingly value, and it gives us another reason to think about heating and cooling together rather than as entirely separate requirements.

At Bellway, we've taken a measured approach, using research, development and early installations to understand what works before moving towards greater volumes. There's a learning process involved for everyone, from designers and contractors through to sales teams and customers, but the opportunity is to create homes that are not only lower carbon, but better suited to the way people will want to live in the future.

03
Connectivity: the enabling layer for shared heat

Heat sharing is easy to describe and hard to deliver. A city may contain many sources of recoverable heat, many buildings that need heating, others that need cooling, and an electricity grid that is under pressure at predictable times. But none of that becomes a system by accident. It requires assets that can see, communicate, respond and be managed together.

That is why connectivity sits at the centre of the urban heat opportunity. In a conventional heating model, equipment is installed, commissioned and largely left to operate within a single building or dwelling. Performance may be checked periodically. Faults may only become visible when comfort is affected. Demand is treated as something to be met, not something that can be shaped. That may be adequate for isolated systems, but it is too blunt for dense urban developments where heat, cooling, energy storage and grid interaction need to work together.

Connected heat pumps change that relationship. They make it possible to monitor performance remotely, detect faults earlier, adjust operation, optimise demand and maintain comfort without treating every problem as a physical call-out. When combined with thermal storage, open controls and software that can respond to electricity-market and grid signals, they can also help shift demand away from peak periods and make better use of lower-carbon electricity when it is available. The Carbon Trust has argued that flexibility should be treated as a core infrastructure challenge, integrated into low-carbon generation, network planning and heat and transport decarbonisation strategies[5].

The value of connectivity is not limited to the heat pump itself. It is what allows multiple assets to behave as part of a wider system. A heat pump with a thermal battery can shift when it draws electricity. A building connected to an ambient loop can take useful heat from the network or reject surplus heat back into it. A group of assets under common digital control can reduce demand at peak times, use cheaper or cleaner electricity when available, and provide operators with a clearer view of how the system is performing.

The wider energy system is already moving in this direction. The Energy Networks Association reported that 22GWh of flexibility was harnessed in Great Britain in 2024, enough to power almost 7,000 average UK households for a full year, with network companies tendering for 31GW of flexibility and contracting 9GW[6]. Most of that flexibility still comes from commercial organisations, but the direction is clear. As more heat, transport and building services are electrified, the ability to control demand intelligently becomes part of the infrastructure challenge.

For urban heat, this means connectivity should not be treated as an optional extra or a software layer added after the main design work is complete. It should be part of the system brief from the start. Developers, engineers and specifiers need to know what data will be available, who can access it, how assets will be controlled, how resident comfort will be protected, how faults will be identified, and how the system will respond as demand changes over time.

In practice, heat sharing depends on visibility and control. Without connectivity, heat pumps remain largely individual pieces of equipment. With it, they can become part of a managed urban energy system: one that can recover heat, integrate cooling, shift demand, support maintenance and adapt to the changing needs of buildings, residents and the grid.

[5] https://publications.carbontrust.com/flex-gb?trk=public_post_share-update_update-text&utm

[6] https://www.energynetworks.org/newsroom/gb-cements-status-as-world-leader-in-energy-flexibility-with-estimated-gbp-300m-savings-for-bill-payers?utm



Why peak demand matters to electricity suppliers

Electricity systems have to balance supply and demand in real time. The challenge is not only how much electricity is used, but when it is used. Demand typically rises during peak periods, when homes, businesses and transport systems are drawing power at the same time. If more heating, cooling and transport are electrified, those peaks can become harder and more expensive to manage.

This is why suppliers and network operators want more flexibility. Government defines consumer-led flexibility as shifting electricity use away from peak periods, or increasing demand when supply is more abundant, cheaper and cleaner. National Grid also notes that flexibility can reduce strain on the network and avoid permanent upgrades built only to meet temporary spikes.

For connected heat systems, the relevance is clear. Thermal storage, controls and shared operation can help move some heat demand away from peak hours without compromising comfort.

Industry VIEW

Connectivity makes shared heat investable

TIM MEANOCK, CEO, RISEHEM ENERGY LIMITED

Connectivity is what turns low-carbon heat infrastructure from a collection of physical assets into something that can be financed, managed and developed as a long-term service. It gives us the data to understand how a system is performing, manage the risks associated with owning it and identify opportunities to generate greater value. Without that information, many of the new commercial models that could accelerate the deployment of shared heat, for example heat-as-a-service, become much harder to deliver.

Take funding, for example, a housing association, local authority or commercial building owner may want low-carbon heating without having to own the infrastructure due to the upfront expense and the operations being outside their core expertise. A third party asset company can finance and operate the system, with customers paying for the service over the long-term rather than the equipment. But if we're taking responsibility for delivering that service, we need continuous performance data to identify problems early, demonstrate that the system is working and support the insurance arrangements that underpin the investment.

The same principle applies to network expansion. Connecting neighbouring buildings can improve efficiency and strengthen the economics of an existing network, but further investment depends on evidence that the original system is performing as expected and that an extension will deliver additional value. Connectivity within the system enables access to that evidence and underpins future financial and insurance underwriting.

Then there are opportunities beyond heating itself. By connecting heat pumps with solar generation, batteries and thermal storage, we can manage energy use across multiple assets and generate additional revenues through electricity grid services. That creates value and an additional financeable income stream which can help offset the substantial upfront costs of heat infrastructure.

For investors, connectivity is therefore much more than a technical feature. It provides the information, control and therefore de-risking needed to turn low-carbon heating into a measurable, insurable and income-generating infrastructure investment which can then expand over time.



04 | The heat sharing city

Cities are usually described as heavy users of energy. That is true, but incomplete. They are also constant producers, movers and wasters of heat. Offices reject heat through cooling systems. Supermarkets chill food while discarding warmth. Data centres consume electricity and throw off thermal energy. Sewers, transport infrastructure, commercial buildings and homes all create heat flows that are usually invisible in the way developments are planned. The result is a familiar urban contradiction: one building pays to remove heat while another nearby building pays to produce it.

What is an ambient heat loop?

An ambient heat loop is a shared pipe network that moves low-temperature water around a building, estate or neighbourhood. Instead of sending very hot water from a central boiler to every home, the loop carries heat at a much lower temperature. Individual heat pumps then raise that heat to the temperature needed for heating and hot water inside each home.

The advantage is that the loop can collect and share energy from different places. Heat rejected from cooling, commercial buildings, data rooms, wastewater or other sources can be put into the loop rather than wasted. Buildings that need heat can draw from it. Buildings that need cooling can reject heat back into it.

In simple terms, an ambient loop acts like a shared energy exchange. It does not just supply heat. It helps move useful warmth and coolth to where they are needed.

A heat sharing approach begins with the place and asks what energy flows already exist.

The heat sharing city starts from a different premise. It treats heat less like a product generated for one building and more like a flow that can be captured, moved, reused and balanced across many users. In this model, heating and cooling are not separate problems. They are connected conditions within the same urban system. A building that needs cooling may become a useful heat source. A residential block that needs hot water may be able to use heat that would otherwise be rejected. Thermal storage can help shift demand. A connected network can decide when to use, store, move or recover heat.

This is not an abstract environmental argument. Low-temperature waste heat from urban sources including data centres, metro systems, public buildings and wastewater treatment plants has been estimated as capable of supplying around 10% of Europe's heat demand[7]. That figure should be treated as an indication of scale rather than a ready-made solution. Much of this heat is dispersed, low grade, commercially complicated or difficult to connect. But it shows that cities contain a resource base that traditional heating models largely ignore.

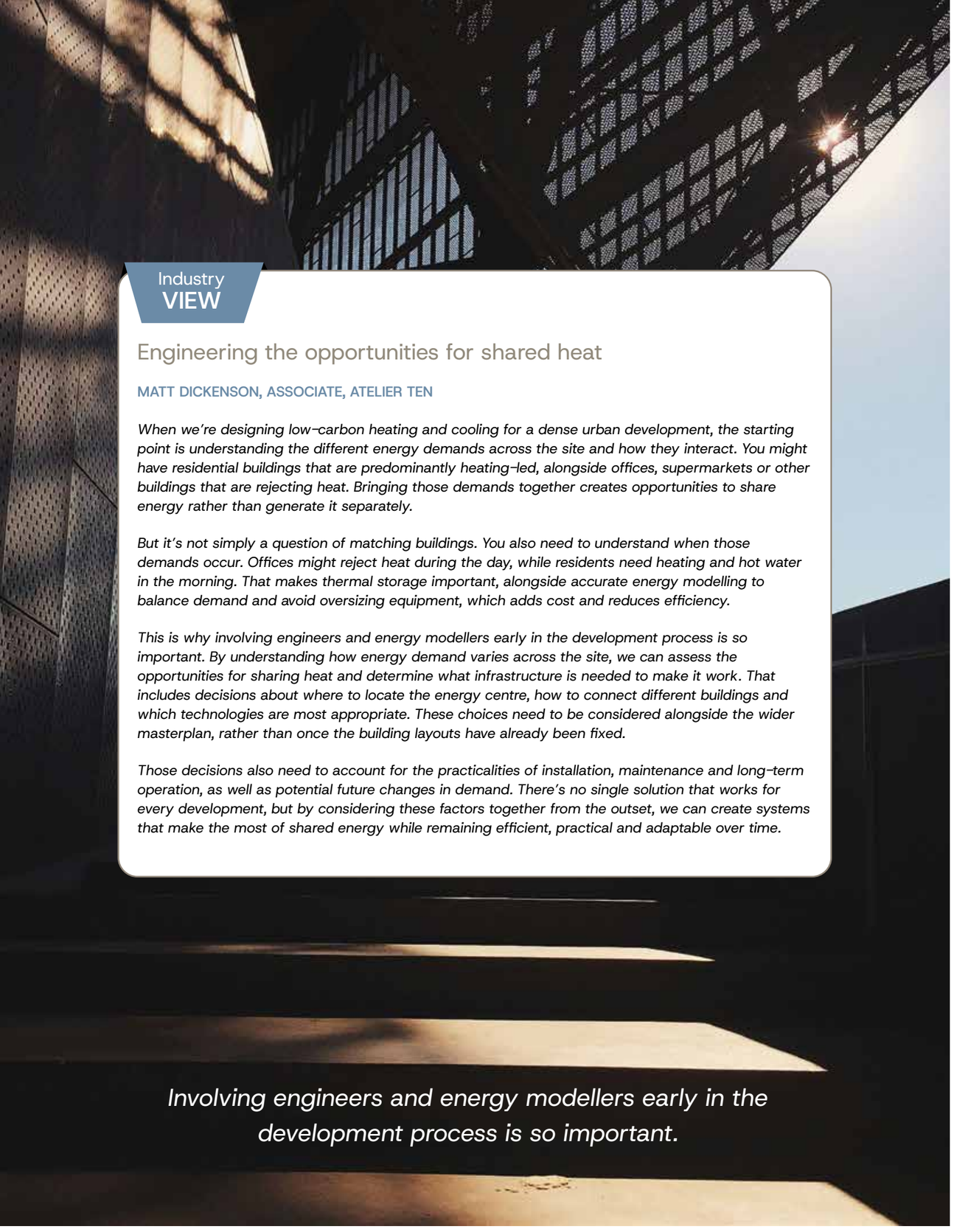
The same density that makes urban heat decarbonisation difficult also creates the opportunity to do it differently. Rural and lower-density developments may have more space for individual systems, but they often lack the concentration of heat sources and demand that makes sharing practical. Cities bring different uses close together: homes, offices, retail, leisure, transport, public buildings and infrastructure. Their loads vary by time of day and season. Their cooling and heating needs can overlap. Their energy systems are messy, but that messiness contains value if it can be connected and managed.

For developers and engineers, this changes the questions asked at the start of a project. A conventional approach begins with the building and asks what equipment it needs. A heat sharing approach begins with the place and asks what energy flows already exist. Where is heat being rejected? Which buildings need heat, and when? Is there cooling demand that could be linked to heating demand? Could an ambient loop reduce waste? Could a refurbishment connect into an existing or future network? Could thermal storage smooth peaks? Could controls allow the system to adapt as occupancy, weather and grid conditions change?

The answer will not always be a shared network. Some sites will still be better served by individual heat pumps or simpler communal systems. The point is not that every urban development should become a heat network, but that every urban development should test whether heat sharing is possible before locking in a less efficient model. That requires earlier mapping, better data, closer collaboration and a willingness to see heat infrastructure as part of the development strategy rather than a late-stage services decision.

The heat sharing city is therefore not a utopian idea. It is a practical design discipline. It asks cities to stop treating surplus heat as waste, cooling as a separate problem and heat pumps as isolated equipment. It asks developers, engineers and specifiers to look across buildings rather than only within them. In doing so, it turns urban density from a constraint into an asset: the condition that makes sharing heat possible.

[7] https://arxiv.org/abs/1912.06558



Industry
VIEW

Engineering the opportunities for shared heat

MATT DICKENSON, ASSOCIATE, ATELIER TEN

When we're designing low-carbon heating and cooling for a dense urban development, the starting point is understanding the different energy demands across the site and how they interact. You might have residential buildings that are predominantly heating-led, alongside offices, supermarkets or other buildings that are rejecting heat. Bringing those demands together creates opportunities to share energy rather than generate it separately.

But it's not simply a question of matching buildings. You also need to understand when those demands occur. Offices might reject heat during the day, while residents need heating and hot water in the morning. That makes thermal storage important, alongside accurate energy modelling to balance demand and avoid oversizing equipment, which adds cost and reduces efficiency.

This is why involving engineers and energy modellers early in the development process is so important. By understanding how energy demand varies across the site, we can assess the opportunities for sharing heat and determine what infrastructure is needed to make it work. That includes decisions about where to locate the energy centre, how to connect different buildings and which technologies are most appropriate. These choices need to be considered alongside the wider masterplan, rather than once the building layouts have already been fixed.

Those decisions also need to account for the practicalities of installation, maintenance and long-term operation, as well as potential future changes in demand. There's no single solution that works for every development, but by considering these factors together from the outset, we can create systems that make the most of shared energy while remaining efficient, practical and adaptable over time.

Involving engineers and energy modellers early in the development process is so important.

05 | Retrofit, refurbishment and existing networks

New buildings set the standard for what comes next. But the urban heat challenge will not be solved by new buildings alone. Most of the homes that will need to be low carbon in 2050 are already standing. The House of Commons Energy Security and Net Zero Committee has noted that four in five homes occupied in 2050 have already been built, and that most will need some combination of low-carbon heating and energy efficiency improvements[8]. For cities, that makes retrofit and refurbishment as important as new development.

This changes the way the heat sharing city should be understood. It is not only a model for master-planned new districts or large regeneration schemes. It is also a way of linking in with existing apartment blocks, housing estates, mixed-use buildings and heat networks that are already in place. The question is not always whether to replace everything. Often it is whether existing assets can be upgraded, connected and made more adaptable.

That is particularly important for urban heat networks. Some were designed around fossil-fuel plants or higher-temperature operation. Others serve buildings with limited visibility over performance, poor controls or little flexibility. Yet these networks are not necessarily obsolete. Pipes, plant rooms, energy centres and building interfaces can provide a starting point for decarbonisation if they are assessed properly. Heat pumps, waste heat sources, lower-temperature operation, thermal storage and better controls can all change the role that existing infrastructure plays.

Refurbishment also brings a different kind of discipline. New build allows systems to be designed from a blank sheet, at least in theory. Retrofit rarely does. It must work around existing fabric, resident occupation, leasehold structures, plant constraints, access issues, maintenance histories and capital budgets. The result is messier, but also more relevant to the real city. Urban decarbonisation will happen in phases, building by building and network by network. A system designed for adaptivity is better suited to that reality than one built around a single fixed end-state.

Before existing systems can be improved, owners and operators need a clearer view of how they actually perform. That means understanding where heat is being lost, where demand is peaking, where plant is underperforming and where controls are too crude. It also means recognising that retrofit will often happen in stages. A building may first improve insulation and monitoring, then adjust controls, then add thermal storage, then connect to a shared loop or integrate waste heat. In this way, refurbishment becomes less a single intervention than a managed transition.

For developers, landlords, engineers and specifiers, this means retrofit should not be treated as a secondary version of the new-build problem. It has its own constraints and opportunities. A refurbishment near an existing heat network may have options that a standalone new development does not. A dense estate may offer enough scale to justify shared infrastructure. A mixed-use building may be able to link cooling and heating internally before connecting to a wider network. The point is to assess what already exists before deciding what needs to be added.

The practical test is whether an existing building or network can become part of a lower-carbon system over time. Some assets will need replacement. Others will need adaptation. Many will need better data before the right decision can be made. The heat sharing city will not be built only through new schemes. It will also be assembled from the fabric, networks and equipment already embedded in urban places.

[8] https://publications.parliament.uk/pa/cm5901/cmselect/cmesnz/453/report.html



06 | Designing for adaptivity

A heat system designed for a single set of conditions will struggle in a city that does not stand still. Urban buildings change use. Occupancy rises and falls. Electricity prices vary through the day. Networks become more constrained at some times than others. Weather patterns are also shifting.

The increase in extreme temperatures, as highlighted by the summer of 2026, means the urban problem is no longer only about keeping buildings warm in winter. It is increasingly about managing comfort, demand and energy flows across a wider range of conditions. Buildings may need heating in the morning and cooling in the afternoon, or vice versa depending on their aspect. A mixed-use development may have homes, offices, shops and communal spaces following different patterns of use. A refurbished estate may gradually add new systems over several years rather than change all at once. And if windows cannot be opened, the issue of fresh air ventilation needs to be considered. A good urban heat strategy therefore needs to be able to adjust.

Adaptivity is different from flexibility, although the two are related. Flexibility is usually about responding to short-term or temporary changes, such as shifting demand away from peak periods or reacting to signals from the electricity system. Adaptivity is longer term. It is the ability of a heat system to keep evolving as requirements change: as buildings are occupied differently, as cooling demand grows, as electricity becomes more variable, as new heat sources are added, or as a development is built, refurbished or expanded in phases.

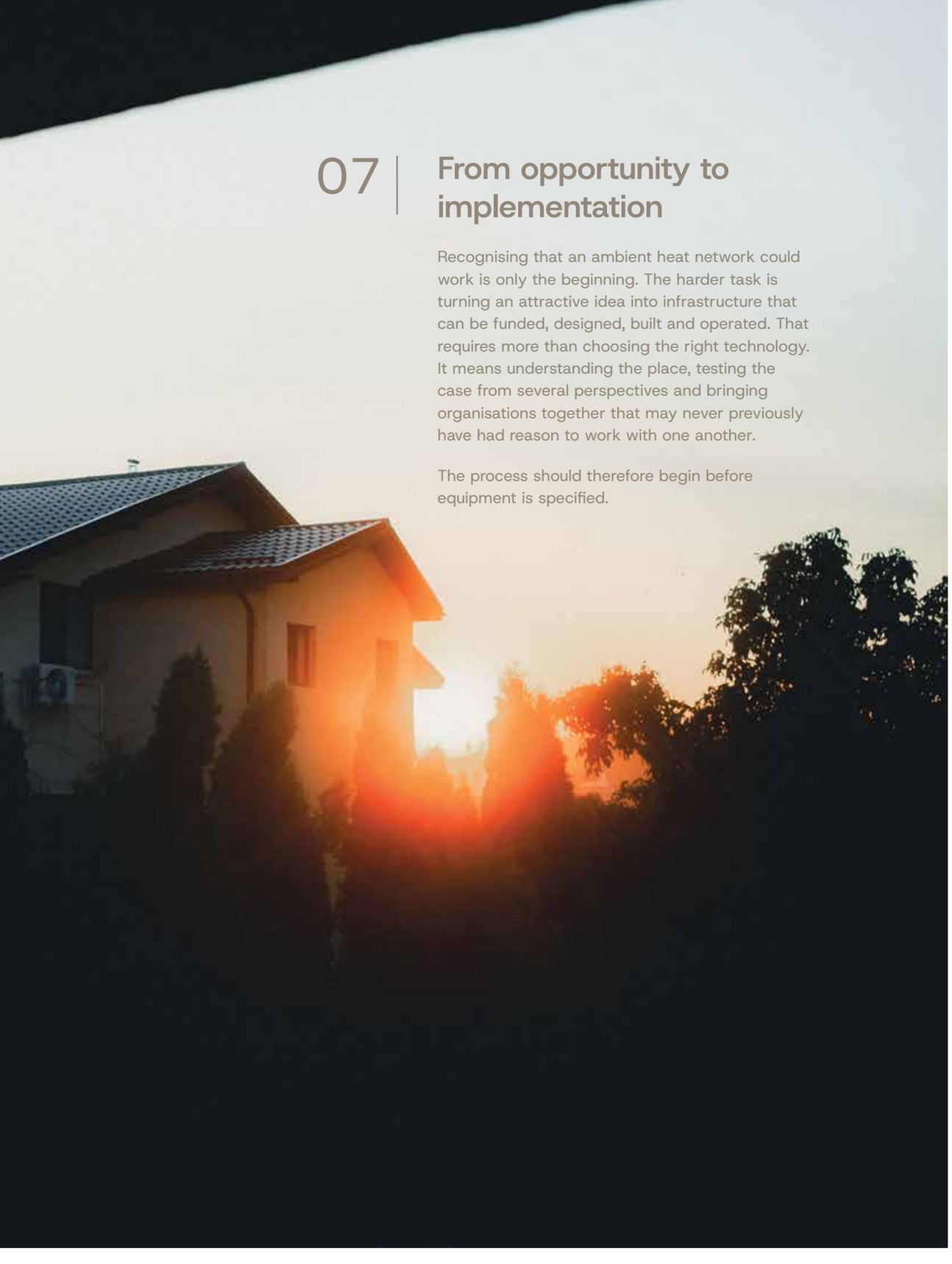
For developers and engineers, this changes the design brief. A system should not be judged only on whether it meets a predicted peak load on day one. It should also be judged on how it will perform in year five or year fifteen. Can it accommodate additional buildings? Can it use a new waste heat source if one becomes available nearby? Can it balance heating and cooling as demand shifts? Can it avoid unnecessary plant replacement? Can operators see enough of the system to improve performance rather than merely respond to complaints?

The most useful urban heat systems will be those that combine physical infrastructure with operational intelligence. Ambient loops, thermal storage, heat pumps, cooling loads and controls all have to work together, but the important point is not the presence of any single component. It is whether the system can evolve without constant redesign. A scheme that can learn from its own performance, adjust to changing patterns of demand and incorporate new sources of heat over time will be more resilient than one designed around a fixed assumption of how buildings will behave.

This has commercial consequences as well as environmental ones. Systems that cannot adapt may face higher operating costs, poorer comfort, more intrusive maintenance and earlier replacement. Systems that can adapt may make better use of energy, reduce waste, support phased refurbishment and protect long-term asset value. For housing developers, landlords and specifiers, adaptivity should therefore be treated as part of risk management, not as a technical refinement.

The lesson for the heat sharing city is that the best systems will not simply be low carbon at the point of installation. They will need to remain low carbon, efficient and manageable as cities change around them. That requires early design choices that leave room for adjustment, better use of performance data, and a willingness to think of heat infrastructure as something that evolves rather than something that is installed once and left alone.

A system should not be judged only on whether it meets a predicted peak load on day one. It should also be judged on how it will perform in year five or year fifteen.



07 From opportunity to implementation

Recognising that an ambient heat network could work is only the beginning. The harder task is turning an attractive idea into infrastructure that can be funded, designed, built and operated. That requires more than choosing the right technology. It means understanding the place, testing the case from several perspectives and bringing organisations together that may never previously have had reason to work with one another.

The process should therefore begin before equipment is specified.

01

Map the place before designing the system

The first task is to understand the environment the network would serve. That means looking beyond individual buildings and establishing the combination of heating and cooling demand across the area. What types of building are involved? When do they need heat or cooling? Is the system heating-dominant, cooling-dominant or reasonably balanced? What existing plant and infrastructure could be retained? What potential sources of waste heat, ground energy or other low-temperature energy are available?

This assessment also needs to consider the wider infrastructure context. Existing and planned heat networks, heat network zoning, nearby energy sources and the physical constraints of the site can all change the answer. A technically attractive technology may still be impractical if there is insufficient space, unsuitable ground conditions or no realistic route to construction.

The objective at this stage is not to prove that an ambient network must work, but to establish which solutions are genuinely possible.

02

Test feasibility from more than one perspective

Technical feasibility is only one part of the decision. The early assessment also needs to address environmental and regulatory constraints, likely construction timescales and the commercial case.

The timing of any programme can be particularly important. Planning, permits, investigations and construction may stretch over months or years, while developments may already have fixed completion dates or funding deadlines. That timeline can influence technology choice as much as theoretical efficiency.

The commercial assessment should similarly extend beyond initial capital expenditure. Project teams need an informed view of capital cost, operating cost and future replacement expenditure, alongside potential carbon savings and other project objectives. Different organisations will weight these factors differently. For one scheme, carbon may dominate; for another, cost, programme or operational simplicity may be decisive.

This is also the point at which projects need permission to reject an idea. An ambient network should not be forced onto a site simply because it appears innovative or low carbon. If another solution performs better against the project's constraints and objectives, that should become clear during feasibility rather than after significant design work has been completed.

03

Treat neighbouring buildings and heat sources as partners: engage, don't assume

Once the physical opportunity has been mapped, the next question is whether the organisations that control those buildings, heat sources or networks are willing to participate. Identifying a supermarket, office, data centre or neighbouring development as a useful source of heat does not mean that its owner will automatically engage.

Each potential participant has its own priorities. A business may be satisfied with its existing heating or cooling system and reluctant to introduce additional operational risk. A supermarket, for example, may be understandably cautious about changes that could affect refrigeration. Building owners therefore need a clear reason to connect, and confidence that doing so will not disrupt their core activities.

This requires active stakeholder engagement. Potential customers and heat providers need to understand how the network will work, what changes will be required inside and outside their buildings, what disruption construction might cause, and what the service will cost. They also need to be involved as the project progresses rather than approached only when a connection is required.

For organisations planning urban heat infrastructure, the feasibility map should therefore contain two things: where the useful energy flows are, and who controls them.

04

Establish who is leading the process upfront

Shared heat quickly becomes a multi-party project. The client or asset owner may need building-services engineers, network specialists, environmental expertise, commercial advisers, funding expertise and specialist designers. Organisations without in-house knowledge may need a lead design consultant capable of coordinating that process and identifying which specialists are needed at each stage.

But more advisers do not automatically produce a better project. Too many parties working from slightly different assumptions can make it harder to maintain a clear design intent.

The practical requirement is therefore clear governance. Someone needs responsibility for maintaining the overall system concept, coordinating the different technical disciplines and ensuring that individual decisions still support the agreed objective. That becomes increasingly important as the project moves from feasibility into detailed design.

05

Define the operating model before completing the design

A shared system also needs a clear answer to a deceptively simple question: who will run it?

One model is for an energy service company or network operator to take responsibility for the shared infrastructure once construction is complete. That can include energy centres and network pipework up to an agreed point of demarcation within each connected building. Beyond that point, responsibilities need to be clearly defined between the network operator, building owner, equipment provider and other parties.

Those relationships are not simply technical. They require commercial agreements covering issues such as metering, tariffs and the price of energy supplied. The operating model therefore needs to be considered while the system is being designed, not handed to someone else once construction is complete.

This is particularly important where heat is being supplied by third parties. The project needs to understand what happens if a source becomes unavailable, demand changes or a building leaves the network. The physical infrastructure and commercial model both need enough resilience to cope with change.

06

Only then move from concept to detailed delivery

Once the project has demonstrated that the system is technically feasible, commercially credible and supported by the necessary participants, the concept can be developed into detailed design.

The level of certainty should increase at each stage. Early feasibility can establish likely technologies, costs, sources and constraints. Concept design can test how the system will actually fit together. Detailed design can then define plant, network architecture, building interfaces, controls and metering. Procurement follows when the project is sufficiently developed for contractors to price the work meaningfully and for bids to be assessed against the intended technical outcome.

The advantage of this staged approach is that major questions are answered before the project becomes locked into a particular specification. It also allows alternatives to remain open where investigations expose constraints.



A practical test before proceeding

Before an ambient or fifth-generation network moves into detailed design, the organisations involved should be able to answer the following:

What is the demand?	What energy sources are genuinely available?	What already exists?
☐ Heating and cooling loads, their timing and whether the network is heating-dominant, cooling-dominant or balanced.	☐ Not only their technical potential, but who owns them and whether they are prepared to participate.	☐ Existing plant, pipework, networks and infrastructure that can be retained, adapted or connected.
What are the constraints?	**What is driving the decision?**	**Are the customers and heat providers committed?**
☐ Space, ground conditions, regulation, planning, network zoning, grid capacity and construction programme.	☐ Capital cost, operating cost, carbon, programme, resilience or another project objective.	☐ Commercial terms, disruption, tariffs, metering and the practical requirements for connection.
Who is leading the project?	**Who will own and operate the network?**	**What happens when circumstances change?**
☐ A clear party responsible for coordinating the disciplines and protecting the system concept.	☐ Responsibility for shared infrastructure, building interfaces, maintenance and performance.	☐ How the system responds if loads change, developments are phased differently or an energy source disappears.

The central lesson is that a heat-sharing network should not be approached simply as a larger heating system. It is a piece of urban infrastructure. Delivering one successfully means connecting buildings, energy flows, organisations, commercial agreements and operational responsibilities as carefully as the pipes themselves.



Who is responsible for long-term performance?

Low-carbon heat raises a difficult question for housing: who should be responsible for how an energy system performs after a development has been sold, occupied or handed over? Developers make early choices about building form, plant space, system design and specification. But residents, landlords, operators and managing agents may live with the consequences for decades.

This is not yet a settled issue. London's "Be Seen" energy monitoring guidance already asks major developments to report actual operational energy performance, reflecting concern about the gap between design intent and real-world use. Ofgem's emerging heat network regulation also places responsibilities on heat network operators, while technical standards are being developed separately.

The debate is whether responsibility should remain mainly with those who operate systems after handover, or whether developers should retain some accountability for long-term performance. As heat systems become more complex, this question will need proper consideration.

08 | Shared heat needs shared responsibility

The heat sharing city is not only a technical proposition; it is an organisational one. A connected urban heat system may involve developers, engineers, specifiers, local authorities, network operators, investors, utilities, technology providers and residents. Each party may make decisions at a different point in the process. Each may carry a different form of risk. Unless those decisions are better aligned, the result can be a familiar one: a technically possible system that is too complicated, too late or too fragmented to deliver.

Part of the challenge is that value and effort are not always distributed evenly. A shared system may create long-term benefits for network owners, building owners and residents, but it can also require more coordination at the point of planning and design. Specifiers, engineers and developers may need to resolve technical, commercial and ownership questions before the benefits are fully visible. That makes shared heat a coordination challenge as much as an infrastructure opportunity.

That coordination challenge will become more important as the market grows. Heat networks still provide only around 3% of UK heat today, yet the government has cited investment potential of up to £80bn by mid-century. That scale of growth cannot depend on isolated projects and ad hoc coordination. It will require a market capable of planning, funding, designing, delivering and operating heat infrastructure with greater consistency.

This growth creates value. A shared system can balance different needs across different users so a heat network serving buildings with varied heating and cooling profiles can make better use of its infrastructure than one serving a single pattern of demand. Heat rejected by one building or process can become useful input for another. Cooling demand can create usable heat; heating demand can create usable coolth. For the owner or operator of the network, that can improve utilisation and help spread costs across a broader base of customers and energy sources. For building developers and owners, it can provide access to lower-carbon heat and cooling without each building needing to solve the whole problem alone. For residents, the potential benefit is a heating and cooling system that is lower carbon, reliable and cost-effective over time.

Developers have an early role because heat strategy is shaped by decisions that may not look like heat decisions at first. Site layout, density, phasing, plant space, roof use, risers, electrical capacity, tenure and commercial model all affect what kind of system is possible. If heat is considered too late, the choice can narrow to whatever can be made to fit. If it is considered early, the project has more room to assess whether heat can be shared, recovered, stored or connected to a wider network.

Engineers and specifiers turn that early intent into something buildable. Their role is not simply to select equipment, but to define the outcomes the system must achieve: low-carbon heat, resident comfort, manageable peak demand, maintainability, operational visibility and the ability to adapt as the development changes. A specification written too narrowly can close down options before the best system has been identified. A better one allows for evidence-led comparison between individual systems, communal plant, ambient loops, heat network connection and future-ready design.

Local authorities and public bodies also matter because urban heat is inherently place-based. Waste heat sources, heat network zones, regeneration plans, grid constraints and building ownership patterns do not sit neatly within the boundary of a single development. Local coordination can help identify where shared infrastructure is viable, where future connections should be protected, and where individual schemes can contribute to a wider decarbonisation plan rather than solving only their own compliance problem.

Heat networks still provide only around 3% of UK heat today, yet the government has cited investment potential of up to £80bn by mid-century.



Investors and asset owners need to look beyond capital cost. A heat system is not a one-off purchase. It is an operating asset that affects service quality, maintenance, energy performance, resident satisfaction and long-term value. A cheaper system that is hard to operate, unable to adapt or exposed to future retrofit risk may not be cheaper over time. Conversely, a system that can incorporate new heat sources, respond to changing demand and support phased refurbishment may create value that is not captured in a narrow procurement comparison.

Operators and residents complete the chain. If a system cannot be maintained well, explained clearly or operated reliably, it will fail commercially even if it is sound on paper. Urban heat infrastructure must therefore be designed with service in mind: who monitors it, who fixes it, who communicates with residents, who owns performance data, and who is accountable when comfort or cost is affected. Shared heat only works if shared responsibility is clear.

This is where companies providing the core equipment can play a useful convening role. Their value is not only in supplying heat pumps, controls or network components, but in helping other parties understand how those assets can work together. Equipment providers with practical knowledge of system design, performance data, controls and operational behaviour can help developers, engineers, investors and operators test options earlier, understand trade-offs and avoid decisions that close down future flexibility. They cannot remove the need for shared responsibility, but they can make the discussion more informed and reduce the gap between the ambition of a heat-sharing city and the practical detail needed to deliver it.

The argument ends where it began: urban heat decarbonisation is not a question of installing more isolated low-carbon equipment. Individual heat pumps will be part of the answer, but cities need systems that can connect buildings, share energy flows, recover heat, integrate cooling, manage demand and adapt over time. That requires developers, engineers, specifiers, local authorities, investors, operators and technology providers to make decisions earlier and together. The prize is not only lower-carbon heat, but urban energy infrastructure that is more resilient, more manageable and better suited to the way cities actually work.



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LONDON OFFICE

Unit 5, Floor 3
25 Christopher Street
London
EC2A 2BS

MIDLANDS OFFICE

Office 10, Tugby Orchards
Tugby
Leicestershire
LE7 9WE

EMAIL

General
salesuk@qvantum.com

Aftersales and Support
support.uk@qvantum.com

PHONE

0330 822 6643

QVANTUM

0330 8226643 | qvantum.com/uk

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