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Enhancing lives

## Designing Healthy Apartments

Insights into the future role of building services  
in multi-residential buildings.

[www.rehau.uk/designinghealthy](http://www.rehau.uk/designinghealthy)



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# Introduction

UK property is still seen as a sound proposition for investors. The idea is best represented by growth seen in the build-to-rent sector, of which multi-residential buildings form a large part. In early 2020 this section of the market was booming with over £1 billion of capital committed in Q1 alone. While activity inevitably slowed down during the spring and summer months, it was quick to recover with £955.7 million earmarked in Q4. As one report from CBRE shows, this asset class was particularly resilient, ending the year with a record-high investment of some £3.5 billion. The real estate business expects this growth to continue, building on established trends that existed long before the pandemic took hold.<sup>1</sup>

Given this trend, it's important to examine this building type as the UK's economy recovers and development commences across the UK. The country's building stock was already facing considerable challenges before the events of 2020, so it's imperative for new builds to now ease the burden. This means designing buildings that are not just compliant but also equipped to meet future needs, particularly those concerning the environment and high-density urban living. This idea forms the basis for REHAU's latest market research, which looks at opportunities in the multi-residential market and in particular what can be done to develop buildings that are 'healthy by design'. The results of that research are discussed in this report.

## The Survey

This report is informed by market research carried out by REHAU in November 2020. The company interviewed:



**520**  
respondents in total



**80%**  
designed M&E solutions



**20%**  
were architects



**25%**  
of respondents primarily work in the multi-residential sector

The results discussed in this report refer only to respondents from the relevant sector.



# Key findings

Sustainability is the top priority for those specifying materials for multi-residential buildings. Respondents also believe it will be the most important design consideration over the next 10 years, followed by temperature control.

**62%**

said that the average lifespan for M&E solutions needs to increase.

**97%**

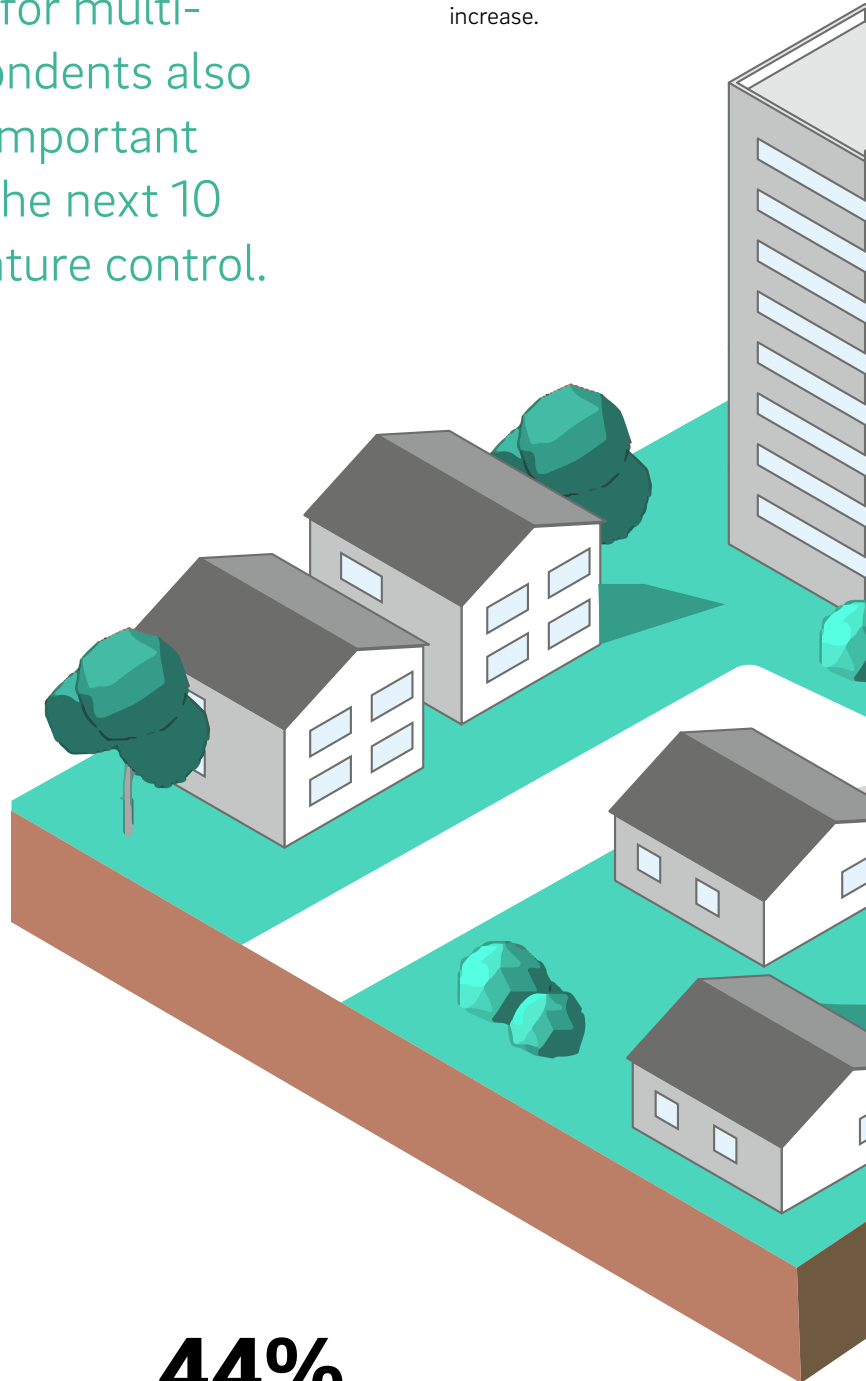
said leaving high-quality buildings for future generations was a medium to high priority.

**50%**

believed demand for district heating networks will increase over the next five years.

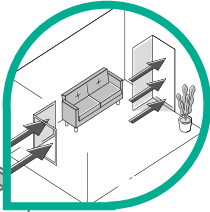
**44%**

believed that wellbeing is 'value-engineered' out of a building's design further down the line.



# 50%

said speed was the main driver for offsite construction methods.



# 59%

said production capacity was the biggest barrier to offsite construction.

# 60%

said the need for good acoustic performance had increased over the last five years.

# 95%

said acoustics was important when specifying building solutions.

# 91%

said risk to human health was a concern when specifying drinking water fittings.



# I. The Market



## What are multi-residential buildings?

Multi-residential buildings are a classification of housing where multiple separate residential units are contained in a single building or several buildings with a larger complex. A common form is an apartment building or block of flats.



## Where are they being built?

Multi-residential buildings are experiencing rapid growth across the country, particularly in towns and cities. According to ONS stats, there were 175,250 dwellings completed during 2019-20, of which 21% were flats with 1 or more bedrooms.<sup>2</sup> The following map shows all multi-residential projects currently in planning across the UK with more than 50 units.



<b>Scotland</b>	98
<b>Wales</b>	38
<b>England:</b>	
South East	354
Midlands & East	255
North	281
South West	213
London	441*

\*Data taken from planning permissions in mid-March 2021

London buildings have traditionally been low-rise, low-density in character but this is now changing. According to the NLA, there were 60 tall buildings (15 storeys and above) completed in 2019 alone of which 88% included residential units. This annual figure represents a 140% increase on the previous year.<sup>3</sup>

2 <https://www.gov.uk/government/statistical-data-sets/live-tables-on-house-building>  
 3 NLA Tall Buildings Survey 2020



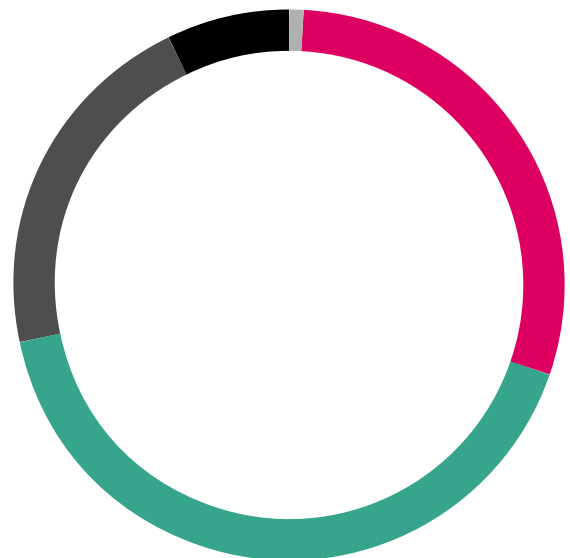
## Understanding the Market

In 1950 the population living in UK cities was 79% - already a large figure – but one that’s set to rise to over 92% by 2030.<sup>4</sup>

This alongside a growing population is raising demand for accommodation in a country with a well-established housing problem.

### How much more, if anything, would you be prepared to pay for a premium product that has a longer lifespan?

- 1-5%**  
1%
- 6-10%**  
29%
- 11-15%**  
21%
- 16-20%**  
21%
- >20%**  
7%



<sup>4</sup> <https://www.theguardian.com/news/datablog/2009/aug/18/percentage-population-living-cities>

For some the solution is building more high-rise apartments, particularly in areas with high population densities. Just 14% of British people live in apartments, one of the lowest figures across Europe where the average is 48%. As one commentator points out, flats are cheaper to heat and use land more efficiently while low-density housing is “simply not sustainable in the long term in a country with the same population as France but less than half its land”.<sup>5</sup>

It’s hardly surprising, then, that the market has invested heavily in the UK’s multi-residential sector, especially in London and other major cities where space is already at a premium. Yet a high volume of developments highlights the need for robust design, not just for consistency but also to ensure properties are capable of rising to future challenges discussed in the following chapters of this report.

Results from REHAU’s market research show there is an appetite for change. For example, 62% of respondents working on multi-residential properties said that the average lifespan for M&E solutions needs to increase, while a similar number said they would pay up to 20% more for a premium product that was guaranteed to last longer.

Perhaps most telling of all was the 97% who said leaving a high-quality building for future generations was a medium- to high-priority.



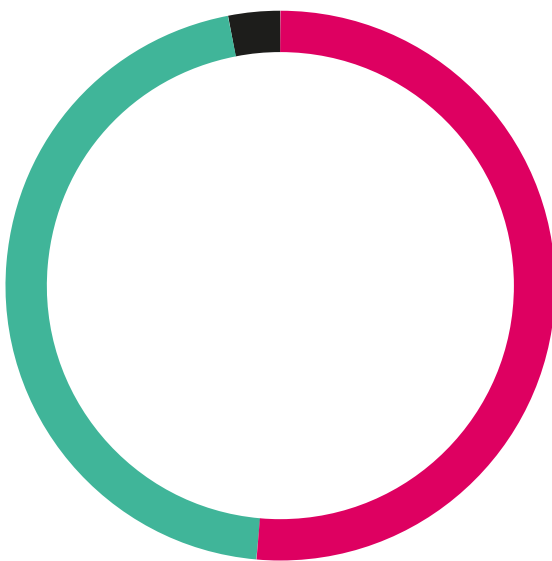
By 2030, the Population living in UK cities is expected to rise to

**92%**

<sup>5</sup> <https://www.independent.co.uk/news/simple-solution-uk-s-housing-problem-apartments-a8326056.html>

# Design priorities

How much of a priority is leaving a quality building for future generations when you specify materials?



3%

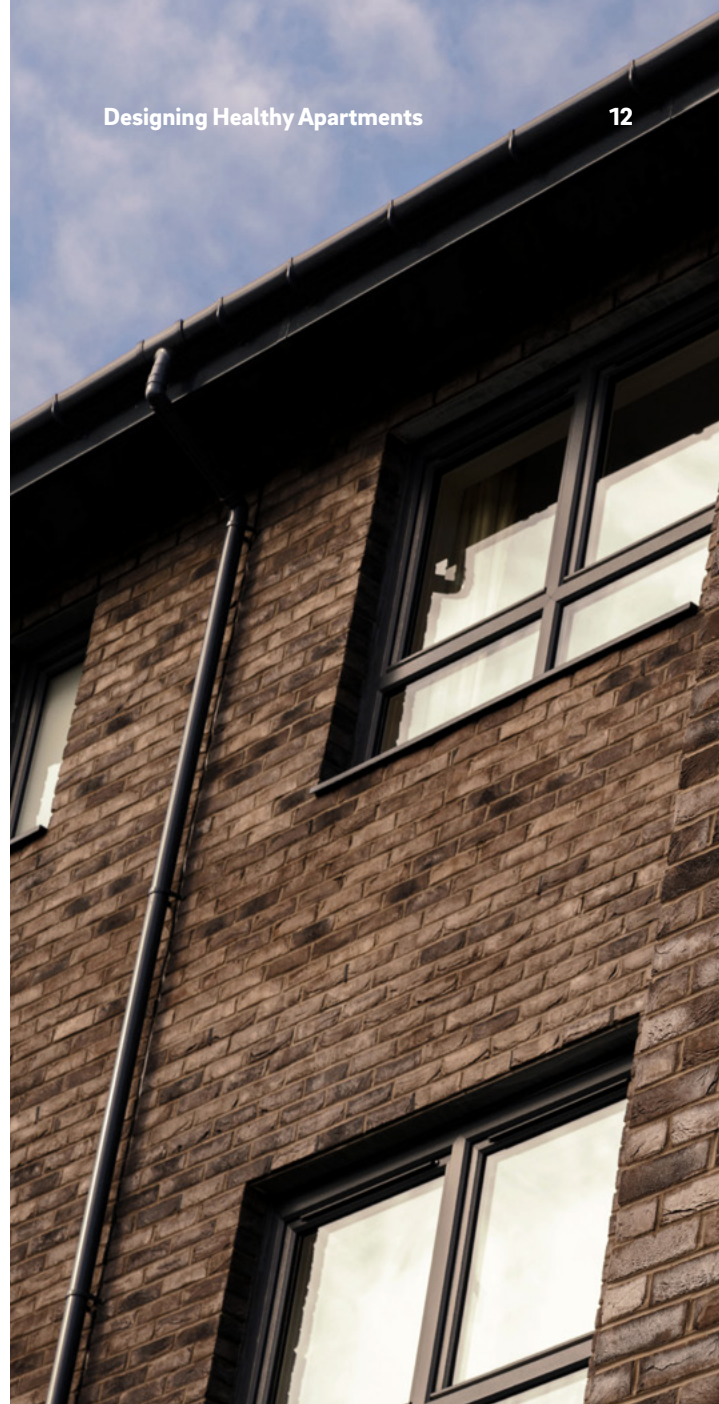
Low priority

45%

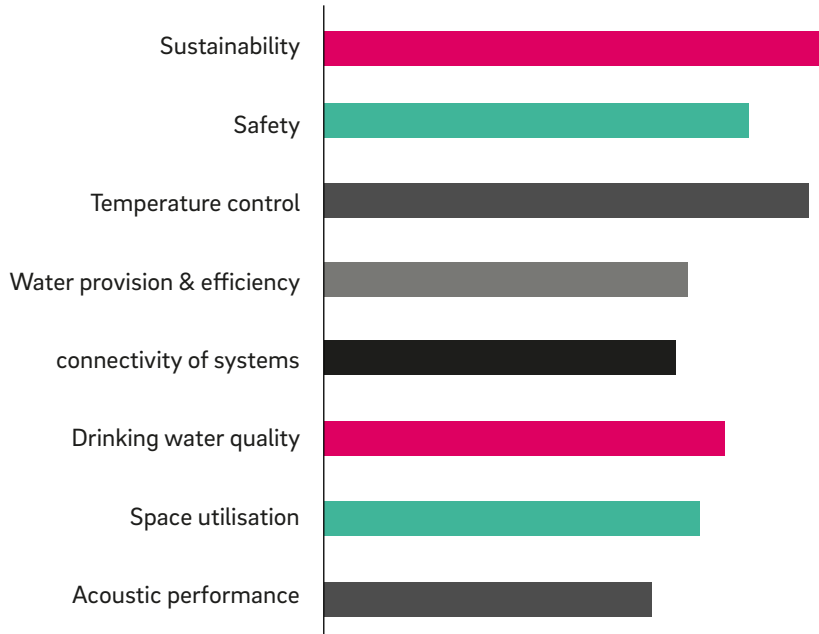
Medium priority

52%

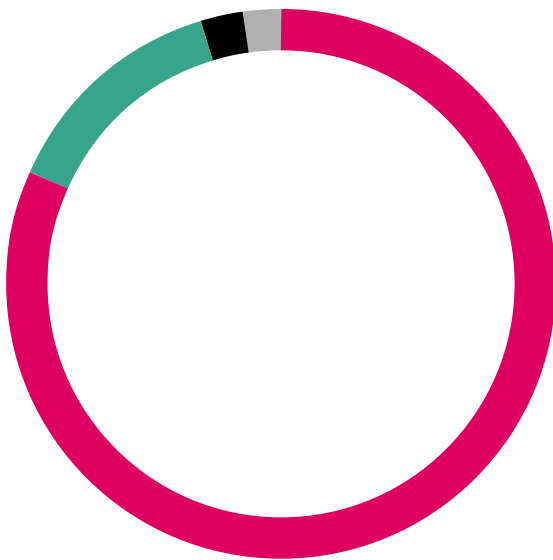
High priority



Which design priorities do you expect to see increase most over the next 10 years?



### Do you believe the average lifespan for M&E solutions needs to increase or decrease?



**10%** Decrease    **2%** Unsure    **2%** Low priority    **62%** Increase



### What are your top priorities when specifying building materials?



## II. Regulation

All UK buildings are legally required to comply with government Building Regulations detailed in the approved documents. For the sake of clarity, this report only looks at the sections most relevant for building services in multi-residential properties.

**Part B** Part B states that a building should be designed and constructed so there are provisions for the early warning of fire, as well as appropriate means of escape.<sup>6</sup> Fire safety has been under close scrutiny following a string of major incidents. One of the most significant changes to come out of the Grenfell Inquiry is the establishment of a national regulator, which will ensure materials used to build homes are safer. This body will also have the power to remove any product from the market that presents a significant risk and prosecute any business that flouts safety rules.<sup>7</sup>

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**Part E** Part E mandates that sound transfer from one flat to another must be reduced by at least 43-45 decibels (dB) through the partitioning wall or floor.<sup>7</sup> However, unlike other countries, the UK's Building Regulations fail to address the issue of building service noise and verification is carried out without any occupant's living in the building. This means technical consultants often need to specify above the regulatory standard.

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**Part F** Part F states that adequate ventilation needs to be provided to promote air flow and prevent excess condensation build up, which could damage the building's structure. Ventilation strategies should be considered at the earliest stages of building design, acknowledging recent amendments that aim to reduce the level of external air pollutants entering through ventilation and reduce overheating.<sup>8</sup>

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**Part L** Part L has recently been in consultation to prepare new dwellings for low-carbon heating systems, with the government proposing a 'fabric plus technology' approach that seeks a 31% reduction in CO2 emissions when compared to current targets. It's expected that district heating and more efficient technologies like heat pumps will be central to these plans.

6 <https://www.gov.uk/government/publications/fire-safety-approved-document-b>

7 <https://www.gov.uk/government/news/new-regulator-established-to-ensure-construction-materials-are-safe>

8 <https://www.practical-completion.co.uk/2020/02/future-home-standards-proposed-changes-to-part-l-conservation-of-fuel-and-power-and-part-f-ventilati.html>

# Updates to the Standard Assessment Procedure

The carbon factors for electricity are addressed in the latest SAP consultation, accounting for the uptake of renewables now contributing to the national grid. This is expected to have a profound impact on the way heating systems are designed, particularly favouring heat pumps. A proposed 55% reduction in the CO<sub>2</sub> emissions factor for electricity means homes heated by direct electric systems will produce virtually the same CO<sub>2</sub> emissions as gas, while heat pumps will produce even less.<sup>9</sup>



**55%**  
reduction in the CO<sub>2</sub> emissions factor for electricity

# Project Spotlight: BBC Television Centre



## Heating and cooling 250 apartments at a landmark London project

REHAU's heating and cooling solutions have helped to transform the iconic BBC television centre in White City. Since 2016 the site has been undergoing extensive redevelopment, with buildings being transformed into a mixed-use development featuring residential housing, offices, hotels and leisure facilities.

The shape of the original Norman and Dawbarn design presented many challenges for M&E contractors, not least the long curved walls that make use of traditional building materials more difficult. Polymer offered one route out of this problem, with its long runs of flexible pipework better suited to the site's vast heating and plumbing network.

REHAU's underfloor heating has been included in 250 of the site's apartments, making use of the company's Universal PE-Xa pipework. In the corridors, REHAU's innovative CoolBoard chilled ceiling system has been installed. This product features integrated loops of piping that circulates chilled water for fast responding and environmentally friendly radiant cooling. The hot and cold domestic plumbing system that runs throughout the corridors uses REHAU's EVERLOC™ jointing technology, which is easy to install, low maintenance and guarantees no leaks.

This work has brought an iconic London building back to life, providing residents with building services fit for high-density urban living.



# III. Environment

Environmental impact is a key part of creating healthy buildings.

Much like the wider built environment, multi-residential properties are now having to be reimagined to meet stricter building emissions targets that will help create a 'net zero' economy by 2050.<sup>10</sup>

The key changes come via the Future Homes Standard. From 2025, all new homes will need to incorporate a low-carbon heating system alongside greener building materials to achieve optimum energy performance. New properties will also be unable to connect to the existing gas network, so alternative solutions will be required to avoid creating more homes reliant on fossil fuels. While a full technical specification is expected in 2023, interim changes have already been made to Part L and F to kickstart the transition.<sup>11</sup>

Fortunately, the market is keenly aware of these pressures and results from REHAU's research show a desire for change. Sustainability was the top priority for respondents when specifying materials on multi-residential builds, with efficiency also scoring high. Sustainability was again the most popular answer when respondents were asked what design priorities they expect to increase most over the next 10 years, followed by temperature control and safety.



## What are EPDs?

Environmental product declarations (EPDs) transparently communicate the performance or impact of any product or material over its lifetime. In construction, for example, EPDs can support a reduction in carbon emissions by allowing contractors and specifiers to compare the impact of different building materials. Using independently verified EPD data, polymer-based plumbing systems have on average a global warming potential around 60% lower than equivalent copper systems.<sup>12</sup>

<sup>10</sup> <https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law>  
<sup>11</sup> <https://www.architectsjournal.co.uk/news/government-sets-out-targets-for-new-future-homes-standard>  
<sup>12</sup> <https://www.bpfpipesgroup.com/media/40678/EB5-Applying-your-knowledge-.pdf>



## District Heating

Results suggest district heating will play a central role for lowering emissions in the multi-residential sector. Fifty per cent of respondents said they expect installations to increase over the next five years, while 75% believed schemes like the Heat Network Investment Project and the upcoming Green Heat Networks Fund will drive up demand.

Most heat networks currently in operation are third generation, using gas CHP to circulate water at 70-95°C. However, to meet net zero targets, commercial-scale heat pumps and use of waste heat sources will be necessary. Indeed, changes to SAP and the phasing out of gas-fired boilers under the Future Homes Standard effectively mandates this approach. The latest fourth generation district heating networks are now geared towards use of this technology, using lower flow temperatures between 40-60°C.<sup>13</sup>

This new design significantly lowers carbon emissions and heat loss, making it an attractive option for developers looking to manage consumer demand against stricter legislation.

The research, however, does reveal some challenges. Traditional methods of supply were cited as a key barrier to the uptake of district heating in the multi-residential sector, followed closely by cost. Some respondents also identified steel pipework as the most common, despite pre-insulated polymer pipes being better suited to the next generation of district heating networks. It's vital these perceived barriers are removed if the sector is to remain on track and develop properties equipped with heating systems fit for the climate challenge ahead.

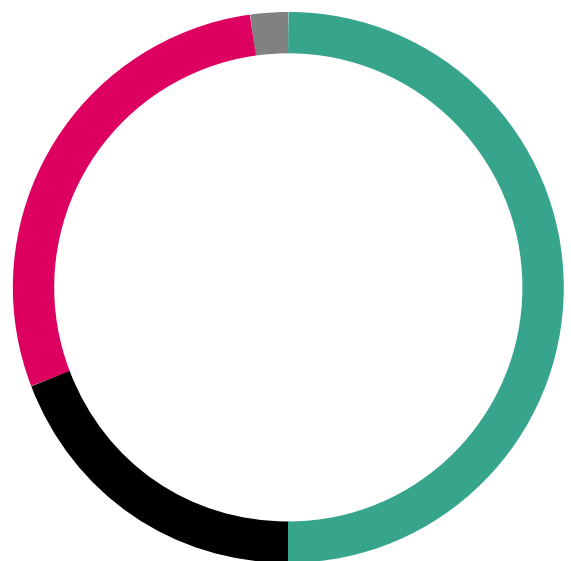
**Do you believe the demand for district heating systems is going to increase or decrease in five years' time?**

**19%**  
Decrease

**29%**  
Unsure

**29%**  
Stay the same

**50%**  
Increase

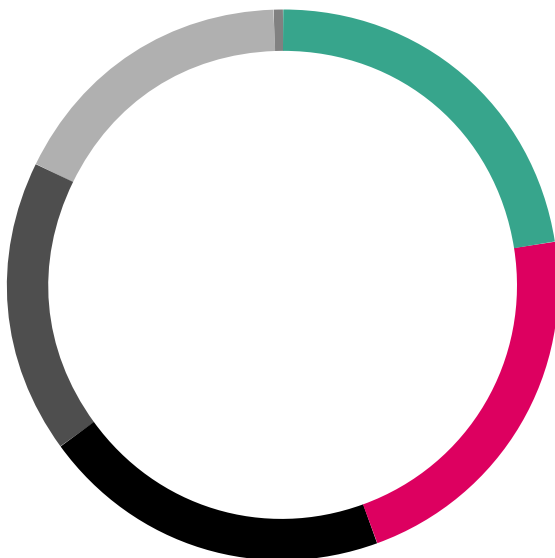


## Offsite Construction

Offsite construction is often seen to have commercial benefits. But it can also help to minimise construction's impact on the environment as it significantly reduces the embodied energy (and carbon) inherent in the build process. As most work is done in the factory, there are fewer trips to a development and total time working on site is lowered.<sup>14</sup>

Fifty per cent said speed was the main driver for offsite construction methods, followed by better quality control and lower costs, while 59% said production capacity was the biggest barrier. Despite some citing offsite's ability to deliver projects for less, a significant number believed it was still too expensive to consider.

### What, if anything, do you think are the biggest drivers for offsite construction methods?



**59%**  
said production capacity was the biggest barrier

- 1%**  
None
- 38%**  
Lack of skilled workers
- 38%**  
Increase social distancing
- 45%**  
More economical
- 48%**  
Quality control
- 50%**  
Faster construction



## Water Waste

It's also important to highlight the issue of water waste, a growing problem that is often overlooked in the design of 'healthy' buildings. Some 3.1 billion litres of water is lost in England and Wales each day due to leaky pipes.<sup>15</sup>

Persistent dampness can also create structural problems and health hazards for residents. While much of this problem is down to the country's porous infrastructure, it's vital that developers begin to consider ways this problem can be tackled. Smart leak detection units, like REHAU's RE.GUARD system, are one solution that could help to meet water efficiency targets set out in Part G of the Building Regulations.<sup>16</sup>

15  
16

<https://eandt.theiet.org/content/articles/2017/12/water-leakage-from-uk-pipes-rises-to-over-three-billion-litres-a-day>  
[https://www.planningportal.co.uk/info/200135/approved\\_documents/69/part\\_g\\_-\\_sanitation\\_hot\\_water\\_safety\\_and\\_water\\_efficiency](https://www.planningportal.co.uk/info/200135/approved_documents/69/part_g_-_sanitation_hot_water_safety_and_water_efficiency)

# Project Spotlight: Hillpark Drive Estate

## Delivering low-carbon heating and hot water to 350 apartments

The benefits of using polymer for sustainable heating is best seen at one of REHAU's landmark projects in Scotland.

In 2016, Glasgow Housing Association secured funding from a green energy fund and the local council to upgrade the heating system found in 350 apartments on the Hillpark Drive estate. The project had two objectives: lower carbon emissions and provide affordable heating for social housing tenants.

Site consultant WSP/Parsons Brinckerhoff suggested the old storage heaters were replaced with a low-carbon district heating system, powered by an innovative industrial air source heat pump. However, due to the long runs required, heat loss was a major concern and the wrong pipework would impact the site's overall efficiency.

REHAU's RAUTHERMEX Plus offered one solution to this problem, with its polyurethane foam insulation guaranteeing high thermal performance over long distances. After talks with REHAU, WSP/Parsons Brinckerhoff decided to specify more than 1km of the pipe for use on the estate.

The company's decision not only simplified the project, as longer runs could be laid with fewer joints, but also provided the site with affordable low-carbon heating and hot water that will last for the next 50 years.



# IV. Wellbeing

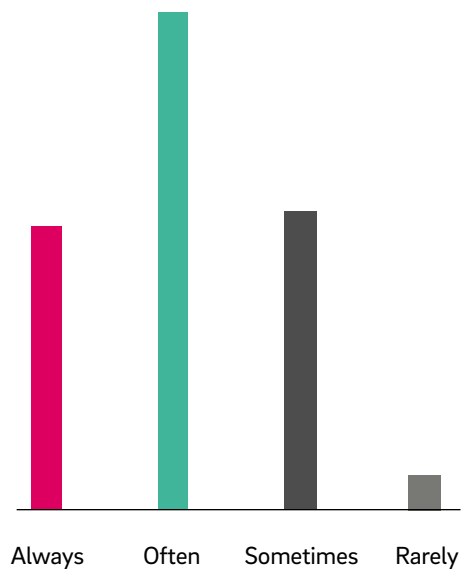
There is now an established body of research that links building design and function to people’s wellbeing, particularly from organisations like the WELL Building Institute.

As one article notes: “The green building movement – which has been growing over the past few decades – has gradually expanded from a focus on reducing water and energy usage to a holistic approach that incorporates how buildings affect the people in them”.<sup>17</sup> The idea is especially important in the multi-residential sector, where there are a large number of people living in close proximity and the potential for problems relating to building services is higher.

Despite this, 44% of respondents still believe that wellbeing is often ‘value-engineered’ out of a building’s design further down the line. This suggests the business case for healthy buildings has yet to fully translate to action. This chapter discusses key issues that are likely to affect residents’ wellbeing in multi-residential properties.

**44%**  
of respondents still believe that wellbeing is often ‘value-engineered’

## How often do you believe occupant wellbeing gets value-engineered out of a building’s design further down the process?



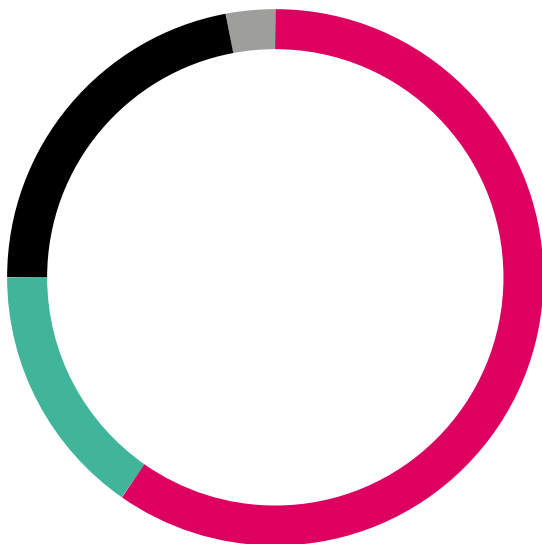
17

<https://www.nationalgeographic.com/environment/article/surprising-ways-green-buildings-improve-health-sustainability>

# Acoustics

It's not difficult to see how important high-performing acoustic building services are for multi-residential properties. In some developments there can be hundreds of residents, raising the chances of audible disturbances not factored in when inspections are first carried out.

## In the past five years, has the need for acoustic building solutions increased or decreased?

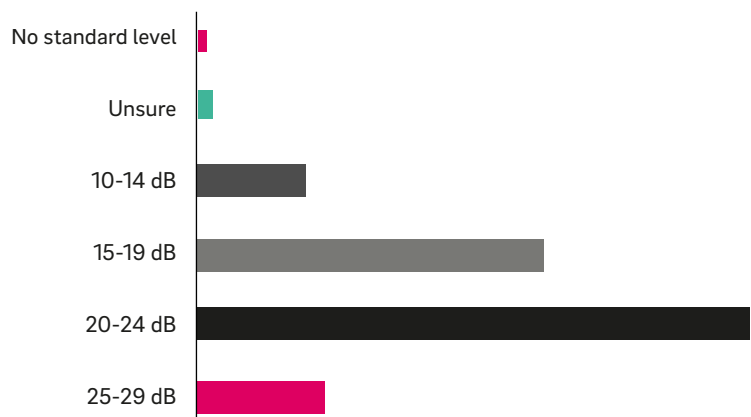


**60%** Increased    **15%** Decreased    **22%** Stayed the same    **2%** Unsure

Unsurprisingly, the results reflect this concern. Ninety-five per cent said that acoustics was either 'somewhat important' or 'very important' when specifying building solutions, while 60% said the need for good acoustic performance had risen in the past five years. The most popular reasons cited for the increase in demand were comfort, privacy and impact on residents' health and wellbeing. It's also important to note those working multi-residential believe the standard level for building acoustics will be 20-24dB within the next five years – noticeably lower than the target test level.

Acoustic performance is essential for residents' comfort but fire safety should not be overlooked. It's not uncommon for specifiers and contractors to miss the link between acoustic performance and fire safety when choosing a soil and waste system, not least because they are separate parts of the UK's Building Regulations. However, with more attention on fire safety in high-rise buildings and the introduction of a national regulator, it's important to now take a holistic approach when specifying building services. Insulated pipes with the correct fire stop, for instance, will not just lower noise levels but also inhibit the passage of fire through pipework. This approach is a relatively inexpensive way to demonstrate compliance with part B and E, while also eliminating the chances of further acoustic issues once a building is fully occupied.

## What, if anything, do you believe will be the standard level for building acoustics in five years' time?



# Temperature Control

It's not surprising to see temperature control scoring high with respondents given the government's focus on reducing overheating in buildings. Properties are now becoming more energy efficient, but this is also raising the chances of excessive indoor temperatures during warmer weather which could pose a potential health hazard. Now the challenge is to provide homes that are warm in the winter and cool during summer while still maintaining high energy performance throughout the year. As Zero Carbon Hub points out, this will mean reducing overheating risk through good planning, design and construction.<sup>18</sup>

One solution is using Thermally Activated Building Structures (TABS). This cooling and heating system uses the large thermal mass of the concrete structure as a buffer for changing loads throughout the day; it does this by running hot or cold water through pipes within the slab. TABS have several advantages when compared to typical comfort cooling systems, though perhaps the most important is the ability to remove heat continually over 24 hours. This reduces the need to purge heat out of the structure when outside air temperature is below the internal temperature.<sup>19</sup>

It's not unreasonable to think that TABS will become central to future building design, especially as summers get warmer and the need to build high-density housing increases. Technologies like this will also help organisations to comply with proposed changes to Part F of Building Regulations that deals with overheating in residential properties.<sup>20</sup>

Smart control systems are another means of managing indoor temperature. Products like REHAU's NEA Smart 2.0 are becoming more popular in multi-residential buildings, particularly those of a high-specification that have underfloor heating installed, and reflect a wider demand for remote and automated control of different building services. They can also control retrofitted chilled ceilings or fan coils in isolation, or in conjunction with underfloor heating or TABS, helping to raise the standard of existing building stock.



Respondents cited temperature control as the second top design priority for multi-residential

18  
19  
20

<https://www.zerocarbonhub.org/current-projects/tackling-overheating-buildings>

<https://www.zerocarbonhub.org/sites/default/files/resources/reports/ZCH-OverheatingEvidenceReview.pdf>

<https://www.energistik.co.uk/part-f-consultations/>



# Drinking Water

Drinking water is an essential part of building services and safe pipework is critical for people’s health. Copper was the most popular material among respondents when specifying materials for this job, followed by steel and polymer. Better hygiene and lower chances of leakages were cited as the main reason among those who selected a metal material. The same reasons were cited by those who said they used polymer or MLCP.

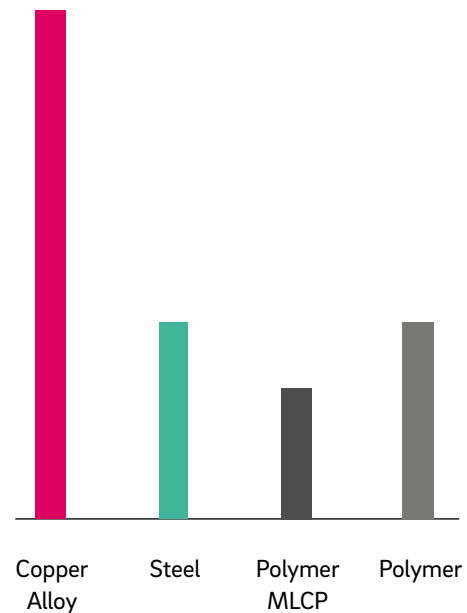
There is plenty of debate on the merits of different pipework, though the concept of ‘healthy by design’ appears to favour polymer. Polymer systems like RAUTITAN have cavity-free joints to stop bacterial growth and the lead-free fittings are less prone to leaching.

REHAU is committed to raising the standard of drinking water in multi-residential properties. RAUTITAN is the result of these efforts, using a premium PE-Xa PN10 pipe and gunmetal fittings that are lead-free by design. PE-Xa pipe is treated to ensure optimal flexibility and once installed delivers cleaner, odour-free water to the homeowner.

REHAU recommends a looped system, rather than a traditional branch network, to promote good water flow throughout the plumbing. It delivers a better system and requires less maintenance once fully installed. Options like this seem especially important when 58% of respondents said they specify fittings containing lead.

On a practical level, polymer will help to raise the consistency of different projects as it requires fewer tools and connections. Moreover, its commodity value is stable and less likely to be targeted by thieves. Eighty-five per cent said fluctuating metal prices had a big influence on their willingness to specify copper pipework, while 83% said they had experienced copper theft on more than one occasion.

## When it comes to heating and water pipes, which material do you mainly specify/ install?



# Ventilation

Effective ventilation is essential for wellbeing and quality windows are central to this strategy.

Building Regulations state that developers should aim for a U-Value of 1.4 W/m<sup>2</sup>K in new builds to ensure a good level of insulation. However, Part F also stipulates that all windows include trickle vents to encourage good air flow, which impact the overall score.<sup>21</sup>

One way to balance this through high-performing glass and window profiles. This will not just lower the U-value but also give developers greater flexibility in other parts of the building's design – e.g., opting for thinner walls to maximise usable space.



## Project spotlight: South Quay Plaza

The sound of silence across 685 high-end apartments .

South Quay Plaza in Canary Wharf is one of the tallest residential developments in Europe. The site has been designed to maximise space and is home to a number of high-rise towers. Acoustic building solutions have been central the development's design, accounting for the high number of residents living in close proximity of one another.

REHAU's RAUTHERM PE-Xa pipework was chosen by specialist Instacoustic to be installed in a total of 685 apartments across 67 floors, providing underfloor heating alongside the company's soundproofed cradle and batten flooring system. This is just one of many Instacoustic products that are designed to exceed the latest building regulations and provide high levels of control against the transmission of impact and airborne sound.

Working together, REHAU and Instacoustic were able to engineer an underfloor heating system that fitted within the flooring's fixed structure. The result was a thermally efficient dry installation that virtually eliminated any noise generated by building services. The project typifies REHAU's ability to work with specialists and rise to different building challenges. It also demonstrates the powerful acoustic properties of polymer and its success in high-end developments where exceptional performance is expected.



## Conclusion

The multi-residential sector is expected to grow considerably in the coming years. It's not just seen as a lucrative area for investors but a key part of managing the UK's housing crisis. This growth restates the need for buildings that satisfy the demands of new legislation, as well as the experiences of those living in busy town and cities. In many cases, the technology is already available to make this a reality.

Fourth and fifth generation district heating, for example, will provide multi-residential properties with low-carbon heat, while technologies like TABS can help to insulation high comfort level for end users without the risk of overheating during summer. However, in other areas, like offsite construction, there will need to be a shift in perception to ensure these methods become industry standard and the benefits are felt.

But it's not just large structural changes where all-round improvements can be made. Acoustic drainage can help to limit the noise generated by building services and, with the fire stop, can also impede the spread of fire. Simple design features like these are ideal for balancing consumer needs with the market's regulatory demands.

It's now incumbent on designers, contractors and specifiers to consider materials that support the 'healthy by design' principle. In some cases, this will mean opting for premium products, like lead-free gunmetal fittings, that are designed to limit eliminate the effects of lead. On other occasions, it will require research into how use of certain materials impact a building's environmental performance. Seeking out products with favourable EPDs will be key to this effort.

Ninety-one per cent of respondents said human health was a key concern when choosing materials. This now needs to translate into action, particularly as results show wellbeing is often value-engineered out of a building's design. REHAU believes polymer-based products will be a key ally in this fight, allowing for greater consistency and ultimately helping to deliver the building services fit for 21st century needs.



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