ADVECO NEWSLETTER

Welcome to Adveco's June newsletter,

This month, we take look at the challenges and responses to retrofitting commercial properties, starting with The Ivy, Liverpool, which has opted to take a more sustainable, all-electric route to ensuring business-critical water heating and consider the wider options and gauge the challenge at a national level of transforming almost 2 million buildings before 2050.

We also consider whether the rush to sustainability overtakes safety concerns when designing hot water installations, and what the best answer is.

And we round off this month with another Ask Adveco Q&A session...

The Ivy, Liverpool – Electric Water Heating For Sustainable Dining

The Ivy is a portfolio of luxurious restaurants providing a high-quality dining experience laced with glamour. In 2024, the chain added The Ivy Liverpool Brasserie to its roster. Formerly a bank, the building would undergo considerable modernisation to deliver this highly anticipated venue located in the heart of the city.

Modern Plumbing Solutions Limited (MPS Limited) was contracted to deliver the restaurant's hot water system, one of the building's most critical services supporting kitchen and customer hygiene.

Having worked with hot water specialists, Adveco at other The Ivy restaurants, MPS was keen to proceed with the company again on The Ivy Liverpool project.

As this would be a refurbishment project, MPS and Adveco would have to work within the existing spatial dimensions of the building and its plant room. There would not be an opportunity to add external plant room space, which meant any system would need to be both compact, efficient and highly resilient given the business-critical nature of hot water supply. MPS and Adveco were also very conscious that the high levels of calcium and magnesium in the local water meant any system installed in the town centre would be prone to damaging limescale build-up. In addition, for The Ivy, it was not only critical that the restaurant be assured of robust delivery of hot water, it must also address the increasingly vital need for sustainability in keeping with the company's wider strategic goals, from the sourcing of food to energy used in its preparation and service.

Working closely with MPS, Adveco presented an application design for the domestic hot water (DHW) that could meet the restaurant's daily operational needs, peak demands and any additional unforeseen requirements whilst meeting expectations for efficient, assured operation and sustainability. The recommendation from Adveco was an all-electric system based around the ARDENT P24 Electric Boiler and ATSI indirect cylinder (calorifier), which MPS agreed would be optimal for this restaurant.

With assured service delivery and sustainability key to the specification Adveco advised for a duplex system – consisting of two P24 premium boilers and a pair of ATSI 300's – which made most effective use of the limited plant room space and would meet all the demands of the restaurant, providing a reliable and robust hot water system.

Deploying the wall mounted ARDENT electric boilers immediately addressed the desire for sustainability, allowing the removal of the former gas-water heating from the building and freeing up considerable space in the plant room to allow for the dual system's installation.

Designed to work as an indirect water heater with a heat exchanger (coil) within a cylinder, ARDENT would provide a high capacity and reliable response to hot water demands in a compact form factor that enables easier, lower cost installation. Within each of the 24 kW heat output units installed in The Ivy Liverpool are three separate, balanced elements, each featuring six or nine heating circuits which can be adjusted to balance the heating load and ensure longevity of the elements. Should one ever fail, a fault output will be signalled and the other elements will compensate until such time as a repair is affected, ensuing consistent service from each boiler for assured service continuity 24/7. As well as the heating elements and controls, an expansion vessel, relief valve and circulation pump are also included within the boiler's wall-mounted case.

For The Ivy Liverpool, the heated water is passed to a 300 litre ATSI single coil cylinder. The stainless steel ASTx range provide the perfect companion for an electric boiler-based hot water system. Tough and compact, they help control initial capital costs, whilst still being an extremely capable choice maximising storage of hot water for when it is most needed, especially when the plantroom space is restricted, as in the case of The Ivy Liverpool. With multiple floors to service, the ATSI also met additional water pressure demands (greater than six bar) making it the most efficient and cost-effective choice for the project.

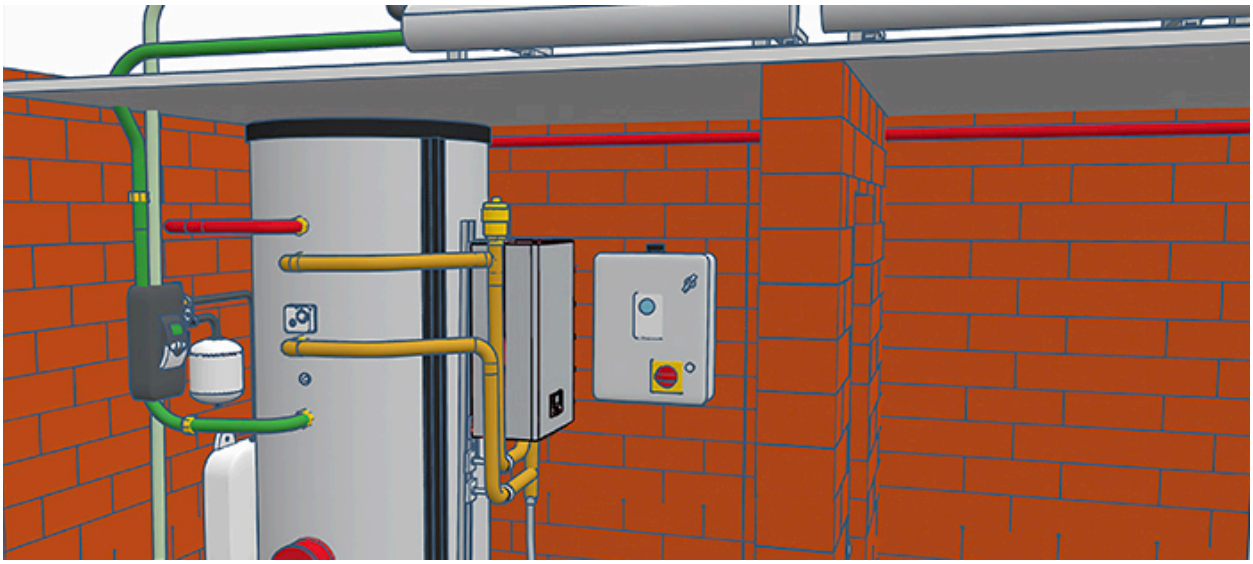
Adveco's design would deploy the same basic building blocks of its award-winning FUSION system. Rather than a pre-specified package, The Ivy's duplex system was a bespoke design but was able to leverage elements of the FUSION system, most notably its ability to prevent the creation of limescale by using the indirect heating method. Due to the fact that the heated water used by the restaurant kitchen and wash basins is separate from that used in the boiler's heating loop, there will only ever be a very tiny and finite amount of limescale that can be deposited on the boiler elements

or inside the heat exchanger, typically where damage would normally occur in the system. The cylinder itself, built from highly resilient AISI 316Ti and 316L stainless steel is an ideal choice, no matter the water conditions but with high intensity temperatures which exacerbate limescale generation avoided in the cylinder itself, limescale is almost completely mitigated ensuring the system has a long lifespan for excellent return on investment.

The Ivy Liverpool Brasserie now offers space for up to 180 diners, who come with high expectations from the menu, service and presentation of the building itself. MPS Ltd and Adveco worked in close cooperation, with MPS impressed with the “very smooth” specialist service provided by Adveco. Although, in this case, integration of air source heat pumps to further reduce carbon emissions from the system was not an initial option, having conversed with Adveco with regards to the possibilities MPS and The Ivy have been inspired to consider this approach for future projects.

CASE STUDIES

Hot Water For Commercial Building Retrofit



One key net zero challenge the UK faces is retrofitting HVAC systems across the commercial built environment. According to the Department for Business, Energy, & Industry Strategy (BEIS), there are 1,755,000 recognised non-domestic buildings in England and Wales. Of these, just 14.6% were constructed after 1996, which is why the UK Green Building Council (UKGBC) estimates that 80% of existing buildings will still be in use in 2050. This means the large majority require some or considerable retrofit if sustainable operation is to be achieved.

The vast majority are gas-connected and still use a gas water heater, and, despite the drive for decarbonisation, like-for-like gas replacement continues to be popular. In response, Adveco offers a range of condensing gas water heaters for organisations seeking to upgrade old and inefficient water heating cost-effectively while better controlling energy use.

All highly efficient, Adveco’s water heaters - including the AD and ADplus ranges - offer easy installation, durability with advanced build techniques and corrosive-resistant construction. With high-capacity models in a wide range of sizes and with the option of built-in storage in the ADplus,

there is a comprehensive choice for the UK's current gas-connected buildings, especially those in soft water areas.

With full temperature control, including heaters connected in cascade, and maintenance self-check of primary components, building operators gain the ability to better manage water heating, ensuring business functions are not penalised with any downtime.

If the intent is to increase the building's sustainability before the mid-2030s, then the water heating system can be expanded by the integration of a heat pump or solar thermal system acting as a pre-heat source. Adveco recently partnered with leading air source heat pump (ASHP) manufacturer Midea to develop the ADV-W range of ASHPs for commercial hot water applications. This advanced range of R32 monobloc heat pumps meets all the technical criteria Adveco requires to fulfil often complex retrofit specifications. This means we can develop and supply the very best low-carbon hot water systems with assured longevity to carry existing building operations to 2050 and beyond in a more sustainable manner.

For true carbon reduction, we would propose installing a renewable pre-heat and then replacing gas for an electric boiler. Operational costs will be higher while grid electricity remains more expensive than gas, but installation is relatively simple and cost-effective with no flueing necessary, zero NO_X and potentially more than 55% lower carbon emissions. This latter figure is achievable with Adveco's multi award-winning FUSION packaged electric water heating system, which offers a range of low-carbon, all-electric applications for commercial projects with a wide choice of pre-sized variants. These incorporate an electric boiler with a stainless steel cylinder, controls and the options of heat pump pre-heat and immersion backup for assured business continuity.

For commercial organisations specifying a hot water system for new buildings or planning to transition from gas to electrical alternatives, FUSION provides an impressive range of choices whether cost, sustainability or business security are the driving factors for specification.

EXPLORE RETROFIT OPTIONS

Is the Race For Sustainability Superseding Safety?

Designing a successful hot water system today necessitates a nuanced approach, carefully balancing adherence to stringent building legislation, paramount safety considerations and economic viability. In addition, there is also the growing imperative of environmental sustainability, which has not only emerged as a key driver in the optimisation of commercial hot water systems, but has started to supersede both cost optimisation and, what should be non-negotiable, safety.

In recent years, the water heating industry has seen immense change as new technologies have sought to improve efficiency, reduce energy demands and decarbonise building emissions. Such technology will often move faster than legislation, creating new design challenges and concerns. In the aftermath of the Grenfell Tower fire, new requirements for the protection of Higher Risk Buildings (HRBs) were introduced in the Building Safety Act 2022, and work continues to extend tighter legislation to other classes of buildings. From the perspective of safety, ultimate responsibility sits with the design and specification of a building and its systems, though many will still look to the poor execution of installation. Despite this, we are still seeing specifications and installation of systems that raise concerns over safety. This is particularly the case at the moment due to the focus placed on the use of heat pumps and solar by the government, seeking to adhere to Net Zero goals.

The issue with heat pumps, especially for hot water generation, is that they were conceived as a low-temperature technology, perfect for domestic heating, but less so for commercial DHW, where high temperatures are required to prevent legionella, a key safety concern for water heating. This has led to the development of refrigerants which are both lower in global warming potential (GWP) and able to generate higher temperatures, in excess of the necessary 65°C working temperatures. Currently, the most popular option for such units is R290, due to its extremely low Global Warming Potential (GWP) of 3 and zero Ozone Depletion Potential (ODP), making it an environmentally friendly alternative to traditional refrigerants. However, its primary drawback and a significant concern for widespread adoption is its high flammability, as R290 is propane.

In the event of a leak, if the concentration of R290 in the air reaches its lower flammable limit (LFL) – approximately 2.1% by volume – and an ignition source (like a spark or open flame) is present, there is a risk of fire or explosion. Propane is heavier than air, so leaked gas tends to accumulate at ground level or in low-lying areas, increasing the potential for dangerous concentrations in confined spaces or poorly ventilated areas.

To mitigate these risks, stringent safety measures and regulations are crucial. Installation and maintenance of R290 heat pumps must be carried out only by highly trained and certified professionals who understand the specific handling requirements of flammable refrigerants. This includes adhering to strict protective zones around the outdoor unit, which must be free from ignition sources, building openings (like windows and doors), and potential underground spaces where gas could collect.

Heat pump manufacturers do incorporate various safety features into R290 systems, such as minimal refrigerant charge, sealed circuits, leak detection sensors, and explosion-proof components. However, human error during installation, inadequate ventilation, or accidental damage to the system can still lead to a hazardous situation. From our own experiences of supplying water heating appliances and heat pumps, we know they get damaged in transit, when stored on site and during movement for installation. So leaks are going to happen, but what does that mean?

While unlikely, catastrophic pipe or component failure could lead to a rapid release of the entire charge. More commonly, small, gradual leaks might occur over time. The danger arises if such leaks

accumulate in an enclosed or poorly ventilated space, reaching the flammable concentration range. ASHPs are most likely to be externally installed, where natural ventilation helps to rapidly disperse any leaks, often preventing them from reaching flammable concentrations. So, leaks are less likely to find the necessary mix of air (within the 2.1% to 9.5% concentration range) to become explosive. However, being denser than air (vapour density ~1.6 compared to air's 1), R290 will tend to sink and accumulate in low-lying areas, depressions, or confined spaces around the unit. This pooling increases the likelihood of reaching a flammable concentration, particularly if enclosed or ventilation is poor – courtyards, or areas with high walls, roofs with parapets and proximity of the ASHP to windows, doors, air intakes, or drainage points offer potential areas where propane could pool and, at around 4% concentration in air, create a significant explosion hazard with the right source of ignition.

R290 has a relatively high auto-ignition temperature of around 470°C, so general hot surfaces are less of a concern, but electrical sparks from components, static discharge, and open flames will provide necessary ignition when fuel (R290) and air are present in necessary levels.
To mitigate this risk, domestic R290 ASHPs are typically designed with very small refrigerant charges, but the latest generation of commercial models are far larger, with recent models ranging up to 450 kW. The propane charge is also greater and can be anywhere from 4 to 50+ kilos.
Liquid propane will produce a very large volume of gas once it vaporises. Approximately 1 kg of liquid propane produces about 0.54 cubic meters of gas. So, 50 kg would produce 23 m^3 of propane gas, creating a significant explosion, but even at 4 kg, the potential explosive volume of gas is 2.16m^3, exceeding current recommendations to separate units by at least 1m.

The concern is that should a unit leak, the concentration of appliances, whether new or older heat pump units, or neighbouring HVAC and solar systems, could easily supply the necessary source for ignition. Consider installations on the sides of buildings, for example, where leaks would drop down beyond set 'safe' distances onto other units. The fear is that it could lead to a 'daisy chain' effect, igniting other units in series. Given the demand for roof space, this raises a host of questions about how system design should and must progress to ensure safe operation.

Of particular concern is the proximity of R290 heat pumps and solar photovoltaic (PV) systems. While the combination of R290 heat pumps and solar PV offers significant environmental and efficiency benefits for commercial buildings, the safety concerns related to shared roof space demand meticulous planning, design, and execution to mitigate the risks associated with R290's flammability and the electrical nature of solar PV.

Solar PV systems operate with direct current (DC), which can produce sustained electrical arcs in the event of damaged wiring or faulty connections. These arcs are powerful ignition sources. Inverters, combiner boxes, and other electrical components of the solar PV system are also inherent ignition risks.

PV systems do catch fire, but it's challenging to provide an exact, definitive number of fires in commercial buildings specifically attributed to solar PV installations. However, available data and reports offer insights into the trends and causes. If we focus on the UK, where some studies have been conducted, the incidence of fires involving solar PV systems is statistically very low, especially when considering the significant growth in installed capacity. However, as the number of installations increases, so does the absolute number of incidents.

Between 2010 and 2022, the UK's Incident Recording System (IRS) recorded 325 fires that included a reference to solar PV. It's important to note that these figures may include instances where solar panels were present on site, but the fire originated elsewhere. According to a 2017 BRE (Building

Research Establishment) report, 26 of 58 incidents of PV fires occurred in commercial properties. More recent reports indicate a significant increase. There were 66 fires related to solar panels between January and July 2023 alone, in the UK, compared to 63 fires for the whole of 2019. This suggests a six-fold increase in solar panel fires over the last ten years.

There were a variety of attributable causes, including frequently cited DC isolators and DC connectors as common points of failure leading to fires, accounting for over two-thirds of equipment faults. As systems age, the risk of failure and fire from components (like inverters) can increase. Poor installation practices are a significant contributing factor, with some reports suggesting that as much as 36% of incidents were attributable to this. This highlights the importance of using accredited and competent installers. Faulty products, design issues, and external influences like moisture ingress, bird damage, or extreme weather can also play a role.

So, what is the answer?

Greater legislation for commercial-grade appliances is required, especially in relation to the safe transport, storage and installation of pre-charged (i.e. monobloc design) ASHPs.

Stricter specification of 'protective zones' or 'safety zones' around the units is required. These zones must be free from any building openings (windows, doors, ventilation inlets/outlets) and potential ignition sources. This is especially the case when approaching layouts that incorporate R290 heat pumps and solar PV arrays. Panels, mounting structures, and associated electrical equipment need to be kept a safe distance away from the heat pump units.

Safety zones for R290 should also exclude any depressions or underground spaces where the heavier-than-air gas could accumulate. This is crucial for flat commercial roofs that might have minor dips or service access points.

For those designing systems, a comprehensive risk assessment is essential for any commercial roof installation combining R290 heat pumps and solar PV. This assessment must consider potential leak scenarios, dispersion patterns, ignition sources, and emergency response.

While the overall statistical risk of a fire directly caused by a R290 or solar PV installation remains low, incidents do occur, and their number is expected to increase as the technologies gain more widespread adoption. The concern is that untried combinations of technologies could have serious implications for the safety of those using commercial buildings, maintaining building services, and ultimately responding to emergencies related to the technology in question.

So, is there a better way?

For the provision of domestic hot water to commercial buildings, the simple answer is yes. All refrigerants, whether R290, PFAS or R32, have their issues. Currently, R32-Based ASHPs offer a more compact, lower-cost and safe means to generate necessary temperatures for commercial applications. At Adveco, our recommendation is to retain R32 ASHPs as a source of preheat to a DHW application, providing greater versatility and assured service for lower investment and operational costs. The approach also considerably simplifies installation and demands for space. Primary heat for top up and peak demands can then be supplied with either a gas water heater or an electric boiler for greater carbon reduction.

For solar preheat, Adveco recommends the deployment of Solar Thermal as opposed to solar PV, especially for gas replacement in existing buildings. Specifications will often aim to deploy solar

photovoltaics (PV) to supply electricity for space heating and water. PV will always offset grid electricity at 136g/KWh, equivalent to 18 kg of CO_2/m^2/annum. Compare this to solar thermal, which offsets gas emissions at 233g/kWh, or 148 kg of CO_2/m^2/annum. This makes solar thermal eight times more effective per m^2 than PV when addressing carbon emissions from water heating, translating to a smaller panel area for solar thermal on the rooftop.

We would always advocate splitting solar water heating (solar thermal) from solar space heating (PV) to gain the greatest efficiencies. A typical office may require, as a rule of thumb, one solar thermal collector per 100 litres of thermal storage capacity. Most commercial-grade applications will typically require six to 20 solar collector panels. These collectors and the gravity-fed system used in Adveco solar thermal applications are also intrinsically safe, so there are no points of ignition.

This hybrid approach, mixing R32 heat pumps, solar thermal and preferably electric boilers in an indirect system, optimises energy demands and ensures robust provision of daily hot water, which also meets sustainability goals. It also maximises the use of space for services and lowers upfront and ongoing operational costs.

PACKAGED ELECTRIC DHW

Ask Adveco...

How does Adveco define sustainability within commercial buildings?

Sustainability encompasses a broad range of functions across the commercial sector, from the bricks and mortar construction to daily operational demands. As a hot water specialist for more than 50 years, Adveco's focus is on how we can take not just new, but also the many existing buildings, to a point where sustainability can be actively demonstrated. For us, that means best addressing the type of energy used and reducing the energy required to meet business-critical hot water demands for tangible carbon emission reductions – all without impacting daily operations or incurring costs that prevent the forward movement of sustainable business strategies.

What are the challenges of upcoming regulation/technical changes that specifiers need to be aware of in the short to medium term?

The Buildings Safety Act has increased scrutiny of hot water systems, which Higher-Risk Buildings (HRB) must adhere to more strictly. For new HRB or significant alterations to existing ones, building control approval is required. This process involves detailed scrutiny of the proposed hot water

system design, ensuring it complies with regulations and safety standards. Of note are the requirements placed on gas water heating and the installation of flues or appliance ventilation ducts, which, if they penetrate compartment walls or floors, should exhibit a fire resistance (REI) that is at least half of the compartment wall or floor. For all buildings over 30m tall, and for some situations in buildings over 18m tall or under 10m deep, flue through compartment walls will not be allowed under the new legislation.

The will likely be further tightening of energy performance standards for hot water systems under Part L. If that is the case, we can expect to see more stringent minimum efficiency requirements for all hot water systems, including boilers, heat pumps, and solar thermal systems. Regulations are also likely to incentivise greater integration of renewable energy sources, particularly solar thermal and heat pumps.

Lowering the storage temperature limits of DHW is also under review, but our technical consensus is that the review will not change the legislation. If it does, we would still design preheat at +50°C and system temperatures at a safe +65°C.

What do your technical teams get most commonly asked about?

The current challenges in the industry revolve around understanding How To Size Electric Hot Water Systems with heat pumps to accurately fulfil a building's DHW demands. Most questions revolve around their efficient ASHP operation, space for the tank and, of course, costs.

One issue we increasingly encounter in the retrofit space is the request to switch from gas to a like-for-like electric system. A 360kW gas application is very different to a 360kW electrical application; the electrical demand is simply enormous. Bringing that additional electrical supply to the building is incredibly expensive, so a lot of our technical design relates to meeting specified DHW demands whilst reducing costly electrical supply, which has the potential to derail sustainability projects.

How do you work with specifiers?

An initial engagement often happens via our Free CPD Offerings. Working together, we will supply the hot water design, which could involve metering an existing building or working within the specification and building legislations. The resultant design will recommend products that Adveco selects and supplies. But we can also create elements for a wider specification, such as designing only the preheat for a system.

Once the specification goes out to tender, it becomes a case of just keeping in touch over the months should there be any updates to the specification that require addressing. Adveco does continue to be involved with the building, though, through the commissioning process and ongoing system service.

What are the key sustainability challenges commercial buildings face when it comes to heating and hot water?

Lighting, heat and hot water are necessities. They are also a key contributing factor to the release of carbon emissions from commercial building stock, accounting for 40% of annual emissions. Water heating alone represents as much as 30% of a building's daily energy demands, so it represents one of the key challenges seeking resolutions. From sink and basin-led demands, to showers, baths, pools, to kitchens, laundry and general demands for regular cleaning, all add to the demands for hot water, making it a business-critical function for most commercial and public sector organisations. Whilst new builds make consideration for such evolving demands as part of the current building

regulations, the majority of commercial buildings are pre-existing, and many will be overdue for renovation.

Of the current commercial properties, only around 14.5% were constructed after 1996, and 80% of all buildings are still expected to be in use in 2050. However, factoring sustainability into older properties is complex and costly. This is especially true when addressing space heating, which can require the building to be adapted in terms of insulation, ventilation, energy supply, pipework and heat emitters. This is the most significant challenge facing building operators wishing to formulate net-zero strategies. There is a silver lining. When water heating reaches a scale seen in commercial properties (requiring a defined plant room space), it is essentially a separate system that requires less and lower impact alteration to the building's fabric, pipework or energy supply for meaningful carbon savings. This means, despite the apparent system complexity, it remains one of the most cost-effective means of introducing sustainability in terms of capital investment and running costs.

If you have a question you would like answered by the team, feel free to send it to Marketing@Adveco.Co, and we will aim to include it in future Q&As.

LEARN MORE

Sustainable Hot Water

FUSION

Adveco's FUSION packaged electric water heaters offer a range of low-carbon, all-electric applications for commercial projects with a wide choice of pre-sized variants combining ARDENT electric boiler,

ADV16-30W ASHPs

The ADV-W air-to-water heat pump range includes 16, 22 & 30kW (3 phase) and 10, 12, & 16kW (single phase) models able to provide hot water output up to 60°C throughout the year for 55°C working flow.

ARDENT Electric Boiler

ARDENT is designed to serve as an indirect water heater or heating system. Wall-hung and oorstanding variants for those seeking to avoid a reliance on gas energy supplies. In hard water areas the ARDENT electric boiler can be used

cylinder, ASHP, controls and immersions.

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to dramatically reduce the costly build up of damaging limescale.

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Adveco 2025 Product Guide

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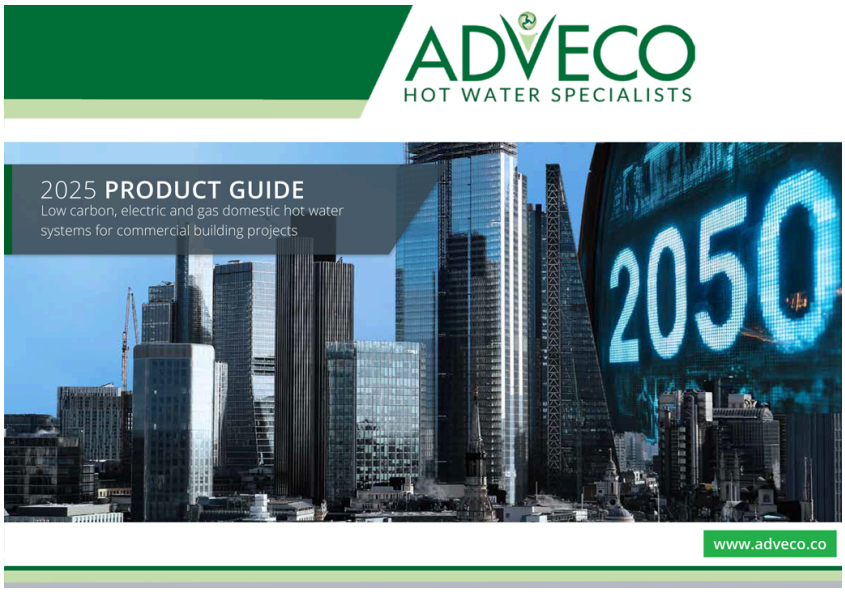
2025 PRODUCT GUIDE



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