ADVECO NEWSLETTER

Welcome to Adveco's May newsletter,

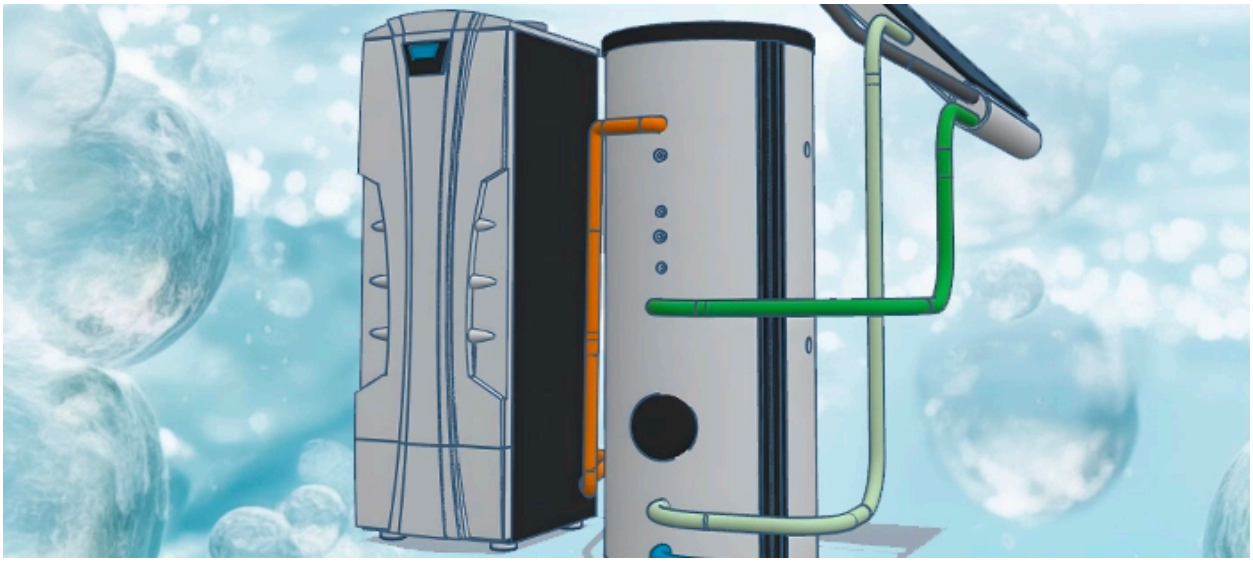
We are very pleased to be able to start this month with another award, commending our work in addressing arguably the biggest challenge facing net zero targets, the retrofit of existing commercial buildings. Following on in a similar vein, we assess the three basic options open to schools looking to upgrade their hot water systems. We answer some common questions on market trends and next steps in water heating which then leads us to investigate the possibilities for carbon negative water heating as a function for achieving net zero by 2050...

Adveco Receives Water Heating Retrofit Award

Adveco has been awarded the Building & Construction Review 2025 Editor's Choice Award for its commitment to innovation in retrofit of commercial buildings. with a focus on more sustainable water heating. The award takes into account recent work carried out by the company to address the continuing demands for gas water heating with increasingly efficient, lower emission gas appliances and the ground-breaking work in site metering and developing hybrid systems to actively support sustainability strategies. The development of the FUSION packaged electric water heating system and the continued efforts to promote an electric approach and sustainable alternatives for retrofit was a deciding factor in giving the award to Adveco.

METERING FOR GAS TO ELECTRIC RETROFIT

Three Steps to Sustainable Hot Water In Schools



The UK school's estate is currently comprised of approximately 96,000 buildings. Approximately 85% of current UK building stock is more than 30 years old, and 80% is expected to still be in use by 2050. This translates into an enormous challenge to introduce greater sustainability to premises which were never conceived to be climate friendly.

However, quick wins can be achieved, notably through the transition to LED lighting and the replacement of ageing water heating. Lighting and heating account for 40% of building carbon emissions, and water heating alone can consume 30% of a building's energy demands. Replacing water heating comes with complexity, but most alteration will take place in the plant room and potentially externally, depending on the scale of works, but overall is low impact and less capital intensive compared to space heating, for example.

There are essentially three options for addressing water heating as part of a sustainability strategy. If, like most schools, buildings are gas connected the first option is to remain on gas alone. The second is to combine gas with low carbon or renewable pre-heat to reduce carbon emissions and control costs. The third and only option for new build is to commit to all-electric water heating.
It may sound counterproductive to stay on gas water heating as a sustainable strategy, but this is the most cost-effective choice now in terms of both capital and operational investments. The latest generation of gas water heaters are highly efficient, maximising energy use for lower emissions and offer a stratagem should the UK opt to embrace a national green gas grid. Expectations for a national hydrogen network, should it proceed, would see a full transition in the 2040s, which aligns with the start of end-of-life decisions for appliances installed now. The current generation of gas water heaters also offers the capability to use 20% hydrogen blend, which is likely the first stage of regional hydrogen transition. So, the technology provided a bridge to next-generation sustainable water heating.

Adding preheat to a gas-fired system creates a hybrid approach. Currently the most popular option, blending improved carbon savings with lower operational costs. Pre-heat is typically generated by either air source heat pumps or solar thermal. This approach maximises the efficiency of the technologies involved, creating water temperatures of at least 50°C. Not enough alone for safe operation, but when combined with a primary heat source, such as gas, it can be used to raise final temperatures to a necessary 65°C as well as meet peak demands and exceptional requirements for hot water. This hybrid approach also means heat pumps need not be excessively large. Compact R32 units are more than capable of supporting pre-heat demands for school buildings, and these are lower cost, reducing capital investment along with carbon emissions. To drive such temperature

outputs from a heat pump, electrical demand will increase, so any heat pump-based system is going to be more expensive to run compared to gas alone. This is where integrating solar thermal is most advantageous. A true renewable and intrinsically safe to operate as the technology is designed to use gravity feed, aided by a small water pump. Using far less space for collectors than photo-voltaic solar systems, solar thermal is the optimal technology for water heating, capable of offsetting at least 30% of system energy demands. As well as active carbon reduction, current cost savings from solar thermal installation mean the technology offers one of the fastest returns on investment in water heating.

The third step toward net zero school buildings is to embrace an all-electric approach. This has inherent operational costs as grid electricity remains approximately four times that of gas but gives an absolute future-proof method for water heating, which will continue to offer carbon reduction as the grid becomes greener. It is also important to consider the overall strategy for electricity use, and most school buildings will have a limited grid connection. To expand that to accommodate all-electric systems, combining heating and EV charging, for instance, can prove extremely expensive. Sizing an electric water heating system is critical; there is a tendency to oversize, leading to spikes in capital and operational investment. This can be avoided by once again adopting the hybrid approach to water heating. Blending technologies to optimise and also offset energy use is the best way to achieve sustainable hot water. And because systems are more compact, installation is far simpler and cost-effective. Plus, there is no flueing necessary, zero dangerous NO_X emissions and potentially more than 55% lower carbon emissions from this approach when compared to equivalent gas-only systems.

Despite industry efforts, there remains no single technology that offers safe, easy-to-implement high-temperature hot water without notable cost implications. A hybrid approach which blends the best of currently available technology remains the more impactful and most realistic investment approach today. For schools aiming to refurbish their hot water systems, a building-by-building approach - which may require a bespoke resolution - is highly recommended if an optimal outcome which best balances carbon reduction and cost is to be found.

Ask Adveco...

What current trends are you seeing in the commercial water heating market?

Although demand is slightly decreasing, gas-fired systems remain a major function throughout the retrofit space. Lack of funding, uncertainty over new technologies and the relative cost of gas versus electricity means we still see a desire for like-for-like replacement, especially where there is high daily DHW demand.

For new builds, there are no new gas connections, so the trend is all about electric and heat pumps to help the building get through Part L. The easiest perceived way to achieve this is to select CO_2 heat pumps and add some photovoltaics (PV) for low-cost electrical energy. The problem is that consultants/contractors are struggling to make this work when keeping return temperatures below 30 degrees. Should the return temperature get too high, the coefficient of performance (COP) drops exponentially, and the unit eventually just shuts off. PV is also far less efficient when it comes to heating water, requiring a greater area of collector at a much higher cost than solar thermal, a technology which, unlike PV, is also intrinsically safe.

This is driving the popularity of R290 heat pump systems. But there remain serious questions, as raised by BESA, over the use of larger amounts of propane required in heat pumps, their safe storage, transportation, and distance from potential ignition sources should there be a leak. This sets concerns over where current heat pump technology for commercial DHW projects needs to go, especially with the expected EU ban on R32 and other HFC-based refrigerants.

From Adveco's perspective, we will continue to advocate hybrid electric/R32 heat pump systems for the time being and recommend solar thermal wherever possible as the best means for reducing energy, emissions and costs associated with the provision of DHW.

How has the commercial sector's approach to sustainability changed over the past decade?

Without a doubt, there is intent to become more sustainable. There is increasing interest in renewable technologies such as solar and the use of heat pumps to reduce carbon emissions. There are also requirements on larger businesses under Streamlined Energy and Carbon Reporting (SECR) reporting to actively invest in carbon reduction, which means they can no longer offset carbon by supporting projects unrelated to the property in question. The government intends to widen the remit of SECR reporting to medium-sized businesses, including franchisees in the next few years, which is expected to hasten the uptake of lower carbon approaches to business operations.

There is also a willingness to present sustainability as an advantage for customers and workers. We saw this initially in the hospitality sector, where 'green stays' were popularised with a commensurate price tag. People are now looking and more willing to pay for environmentally friendly lifestyles as the provider will be perceived as forward-looking and more invested in the comfort and safety of its customers. So, most organisations will claim to be prioritising sustainability to meet mandated environmental reporting needs, building regulations and to attract environmentally conscious customers and investment.

We see a somewhat different picture, though. Adveco commissioned a report on the adoption of technology for water heating over the 2019-2023 period. Of those undertaking retrofit or replacement of existing systems, our research indicates that gas-fired water heating continues to dominate. It accounted for a large proportion of recorded installations across the commercial sector, making it the most popular choice for supplying heating and hot water demands. All lower carbon technologies - electric water heating, air source heat pumps (ASHPs) and solar thermal - are showing increasing specification, yet adoption rates have remained generally low across. Of these low-carbon technologies, ASHPs have exhibited a more rapid uptake in the latter two years, but the number of sites deploying the technology remains lower than expected and is almost exclusively associated with new builds. Early indications suggest 2024 saw these numbers dip, which would align with wider European reporting.

How do you see the commercial water heating market evolving in the coming years?

With the drive toward greater sustainability, the commercial water heating market has already undergone significant change in the past decade, but we still expect gas to remain an option until the mid to late 2030s for retrofit purposes. We also expect that hydrogen blends and then full hydrogen-based applications will be applicable for industrial and larger commercial projects. This will develop in tandem with heat pumps as work continues to identify safe-to-use refrigerants with a low to zero global warming potential (GWP). In the interim, we expect heat pumps to continue to be best applied for the supply of system preheat with a top-up provided by electric boilers. There is also a strong urge to employ solar thermal for pre- or mid-heat in more complex systems.

The use of offsite construction to accelerate project workflow and secure high-quality manufacture/installation will continue to grow, and we see it as an increasingly popular choice for securing dedicated roof-based DHW plant rooms for commercial projects.

We also see the value of increased intelligence, with smart controls, onboard water, and energy metering offering improved energy management, service and maintenance scheduling, and evasion of critical failures. This helps reduce emissions, capital and operational investments and prolongs the lifespan of DHW systems.

Is Carbon Negative Water Heating Achievable?

In the pursuit of net zero commercial building stock in the UK, achieving carbon negative water heating is the ultimate goal, but is it even possible today? The pursuit of net-zero carbon buildings necessitates a critical look at every aspect of their energy consumption. While often overlooked, hot

water systems can contribute significantly to a commercial building's carbon footprint, being responsible for as much as 30% of its daily energy demands. To address this challenge requires an examination of technologies, strategies, and considerations involved if this ambitious goal is to be achieved.

So, what do we mean by a carbon negative water heating?

A carbon negative water heating system not only reduces carbon emissions but also actively removes more carbon dioxide from the atmosphere than it emits during its entire lifecycle. This encompasses three forms of carbon - embodied, operational and sequestered. Embodied carbon includes carbon emissions associated with the extraction, processing, transportation, and construction of the system components. Operational carbon refers to emissions resulting from the energy consumption of the system throughout its operational life. Carbon sequestration deals with the potential of the system to contribute to the removal of carbon dioxide from the atmosphere and be stored in either solid or liquid form.

Sequestration can be achieved by managing or enhancing natural processes, such as reforestation to absorb carbon dioxide (CO_2) through photosynthesis; adding iron or other nutrients to the ocean or simulating natural upwelling processes to bring nutrient-rich water to the surface to stimulate the growth of phytoplankton, which absorb CO_2; or reacting CO_2 with minerals to form solid carbonate compounds. Technology-driven artificial processes are also likely to play an increasing role in the removal of carbon, including carbon capture and storage (CCS), direct air capture (DAC), and enhanced weathering.

CCS involves capturing CO_2 emissions from industrial sources or power plants, transporting it, and storing it permanently underground in geological formations. DAC technologies directly extract CO_2 from the atmosphere using specialised plant. Enhanced weathering involves accelerating the natural process of rock weathering to absorb CO_2. Burning fossil fuels in oxygen instead of air (chemical looping) and capturing the resulting CO_2 also offers a means for carbon sequestration.

In terms of domestic hot water (DHW) provision across the commercial built estate, national projects are more likely to drive uptake of carbon sequestration on a meaningful scale, but service provision exists for organisations willing to invest, and if cost-effective, should form a key part of any corporate sustainability strategy. Most organisations will initially concentrate on better managing embodied and operational carbon since technology already exists to help achieve strategic goals today.

Material selection and construction lie at the heart of efforts to better manage embodied carbon. Manufacturers are beginning to prioritise the use of low-embodied carbon materials in the

construction of the hot water system, such as recycled or bio-based materials. The use of recycled steel is a particular goal given the amount required for often very large commercial vessels. In a similar style to carbon passports - rather than individuals being assigned a yearly carbon allowance for travel, to limit greenhouse gas emissions and encourage sustainable travel habits - products could be tagged to indicate the embodied carbon, declaring levels of recycled materials, enabling value to be calculated not only at purchase/installation but critically at end-of-service.

Utilising prefabricated and modular construction techniques can reduce waste, improve efficiency, and minimise on-site construction activities, thereby reducing embodied carbon. Adveco is a proponent of the offsite construction technique for DHW plant rooms, which is predominantly deployed in partnership with customers aggressively seeking to drive sustainable buildings across their portfolio. There are tremendous advantages in terms of cost, quality and speed of roll-out that would best serve the interests of most customers. Adveco has also proposed the benefits of a modular approach to commercial DHW applications, with a particular focus on the implementation of heat pumps.

Managing operational carbon is, no doubt, the greatest challenge for sustainability strategies, which must address the often high daily energy demands of DHW. This is exacerbated by the longevity of DWH systems and the gradual degradation of their efficiency. It is not uncommon for water heaters to more than exceed the expected 12 to 15-year operational window. Regular service and maintenance will greatly extend the life of an appliance up to two decades, but on occasion, far longer with systems still in use 30-40 years after initial installation. On paper, that sounds like a fantastic return on investment, certainly in terms of capital spending. However, there will be a considerable impact on operational efficiency from ageing parts, corrosive damage, or limescale build-up, but particularly the lack of technical advance that has characterised product development across the past decade. Everything from advances in burners, better conductive and stronger materials, functional design and energy recovery to smart controls and onboard metering and management have made the latest generation of water heating appliances, whether they be gas-fired or electrically powered, far more advanced and more efficient. This means they inherently require less energy to achieve the same or better results for greater operational carbon reduction as well as cutting running costs.

Adveco is a particular proponent of renewable energy integration through the design of hybrid systems that optimise how technologies are used to heat water, maximising energy in versus hot water out. For many, this is a key strategic goal, and there are pre-eminent technologies that can enable real gains, even for the smallest, most low-impact projects.

One of the most valuable technologies available to commercial organisations seeking to cut operational carbon is solar thermal. Harnessing solar energy to heat water directly offers a proven and readily available answer to decarbonising hot water systems. Integrating high-efficiency solar thermal collectors with the latest generation of cylinder and controls can significantly reduce reliance on grid energy. The capability to integrate a smaller number of high-efficiency collectors in a wide variety of configurations on building roofs and facades, along with silent operation, makes the technology especially applicable for commercial projects aiming to maximise external spaces for on-site energy production.

The other core technology available right now is the heat pump. Both geothermal and air source pumps have a role to play in delivering carbon negative water heating. Utilising the stable temperature of the ground to extract heat, geothermal heat pumps can offer a reliable and efficient option but are limited by the suitability of ground conditions and the initial cost of ground works. For large-scale and more industrial projects, these can be a good option, but small to mid-scale commercial sites may struggle with the limitations, meaning air source heat pumps (ASHPs) remain the more viable choice. Not necessarily the most cost-effective means of heating water, especially

for commercial-scale projects, heat pumps will actively reduce carbon emissions, so they are an important tool for achieving negative carbon operation. Heat pumps lose out to solar thermal due to the need for electrical input to drive the compression of refrigerant necessary to create heat. As efficiency drops, energy demand to drive the process will increase, and so long as the grid electrical supply uses gas-fired power stations, it cannot be regarded as a true renewable. That said, the technology can be a meaningful contributor over time as the grid becomes increasingly greener.

Looking forward, a green grid will see a balance of energy inputs, increasing renewable feeds from solar and off- and onshore wind. There remain high hopes for natural gas to be replaced by green alternatives, in particular hydrogen, maximising the existing gas network and in turn minimising impact on commercial operations with legacy gas-grid connections. One of the key questions remains how to safely decarbonise electricity generation. Coal-fired power stations are finally a thing of the past, but gas is still burned, and there continue to be fears over nuclear generation. One particular technology which is gaining considerable attention, though, is thorium-based nuclear power. Naturally occurring and abundant in the earth's crust, the slightly radioactive metal is nearly three times more abundant than uranium and can be used in many types of reactors. A key advantage of Thorium nuclear power reactors is that they will produce less amounts of waste compared to other nuclear fuels, avoiding large storage facilities, high radiation levels and resultant high temperatures. The radioactivity levels of thorium waste are found to fall in a much shorter period than nuclear waste produced by other fuels.

Perceived as a low-cost, safe and sustainable energy, the technology is progressing swiftly. In the UK, there are currently five operating thorium reactors and three de-fuelling reactor sites. With proposals in place for further plants to be built in the next few decades, the technology offers the potential to meet electricity demands, which can service both the commercial and residential built estate with more cost-effective and environmentally friendly grid electricity. For water heating, this would drive focus on 100% efficient electric boilers and decrease the demand for heat pumps in favour of technology able to offset energy demands, such as wind and solar.

Long term, there remain several question marks over next-generation grid power, both in terms of technical advancement and investment at a national level. In the shorter term, there is still much that can be done to influence the evolution of water heating systems towards a carbon negative model.

A major function of energy management revolves around its storage and deployment. Working better with the grid is certainly going to be a part of the solution for larger-scale projects, where integrating hot water systems with smart grids for demand-side management allows for dynamic control of energy consumption, optimising usage during periods of low demand and maximising the utilisation of renewable energy sources. But one of the basic tenets of well-designed water heating is the optimal utilisation of thermal energy storage in the form of cylinders or tanks. These vessels are deployed in water heating the same way batteries are used in an electricity-based system, storing and deploying energy - in this case heat - as and when required. The predominant use is to manage heat from renewable sources generated as system pre-heat and any hot water returning from the system to provide balanced resources able to meet all the daily and peak demand periods. The better the storage is designed and managed, the better the overall system efficiency, resulting in reduced demand for grid energy.

An efficient system will avoid waste wherever possible, so capturing and utilising waste heat will be an important function of a water heating system, and this can be improved by using waste heat from other building systems, such as chillers or ventilation systems. Integrating heat pumps with waste heat recovery systems can further enhance efficiency and reduce reliance on primary energy sources, or future options involve the use of outside sources in the form of local heat networks, all of which can be directed to supply additional preheat for the generation of domestic hot water.

Undoubtedly, there is a need to drive buildings toward 'carbon negative' water heating. It is achievable, but numerous challenges lie ahead of the industry. Higher initial investment compared to traditional systems still goes without saying, from a macro national scale down to each and every building. Those costs come from rolling out new technology and better integrating renewable energy sources with the grid. The technical complexity of integrating multiple technologies and then optimising those elements and a national scale is immense, and to so extent will be mirrored in each building to maximise performance. At this local scale, we also see ongoing issues from space constraints - especially in highly built-up areas - where incorporating some renewable energy technologies may require significant space or be constrained by existing infrastructure, whether above or below ground.

Building carbon negative hot water systems is a challenging but achievable goal. By embracing a multi-faceted approach that integrates renewable energy sources, waste heat recovery, and smart grid technologies while minimising embodied carbon, we can create hot water systems that not only reduce emissions but also actively contribute to carbon sequestration. Continued research and development, along with supportive policies and incentives, will be crucial to accelerating the adoption of these innovative technologies and paving the way for a truly sustainable built environment by the 2050 target for net zero emissions.

NET ZERO & DHW

Sustainable Hot Water

FUSION

Adveco's FUSION packaged electric water heaters offer a range of low-carbon, all-electric applications for

ADV65-110W ASHPs

ADV65-110W is an integrated air-to-water heat pump system that provides an energy-efficient method

ARDENT Electric Boiler

ARDENT is designed to serve as an indirect water heater or heating system. Wall-hung and oorstanding variants for those seeking

commercial projects with a wide choice of pre-sized variants combining ARDENT electric boiler, cylinder, ASHP, controls and immersions.

FIND OUT MORE

to secure low-carbon domestic hot water (DHW), as well as space heating and cooling for larger commercial buildings.

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to avoid a reliance on gas energy supplies. In hard water areas the ARDENT electric boiler can be used to dramatically reduce the costly build up of damaging limescale.

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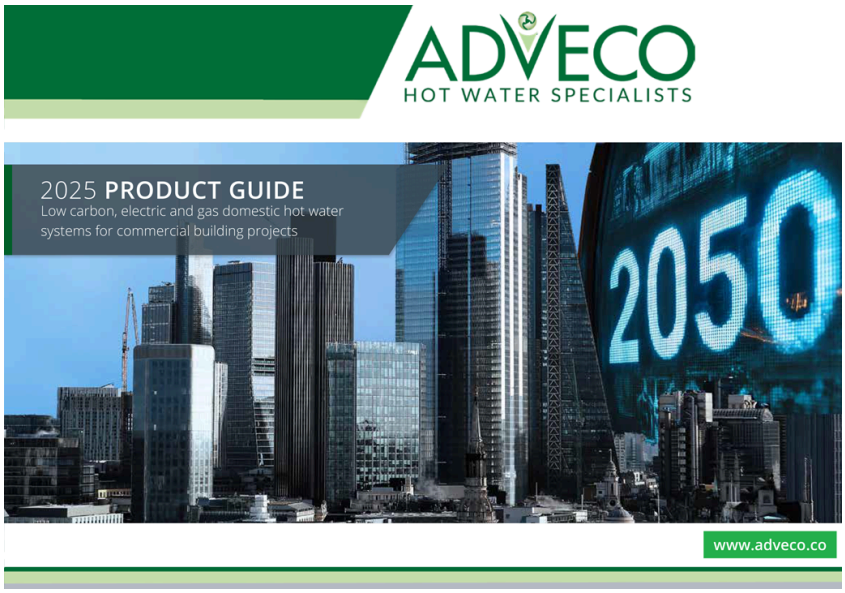
Adveco 2025 Product Guide

Get the handy guide to Adveco's current product range for 2025

2025 PRODUCT GUIDE



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FPi R32 monobloc Air Source Heat Pump
FUSION packaged electric water heaters
Electric Boilers
Hot Water Cylinders, Indirect Water Heaters, Calorifiers & Buffers
Commercial Gas-Fired Water Heaters
Standalone Heat Recovery from Chillers
Offsite Constructed Packaged Plant Rooms
Premium Chilled Water Systems

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