JM

Fuelling progress

Unleashing carbon-reducing technologies

Johnson Matthey
Inspiring science, enhancing life

World-class technology: Ready now and fit for the future

Johnson Matthey (JM) is an accelerator for change. As the world faces the challenges of global warming, we are fuelling progress with world-class technology and expertise.

As a global leader in sustainable low-carbon solutions, we are continually licensing technologies to reduce carbon emissions from fuel production, power generation, chemical production, and other hard-to-abate sectors. These technologies are informed by our expertise across both traditional and sustainable feedstocks, and as a trusted, experienced technology partner we help organisations utilise fossil-based feedstocks efficiently, or pivot towards alternative feedstocks such as biomass, municipal solid waste, captured carbon dioxide and green hydrogen.

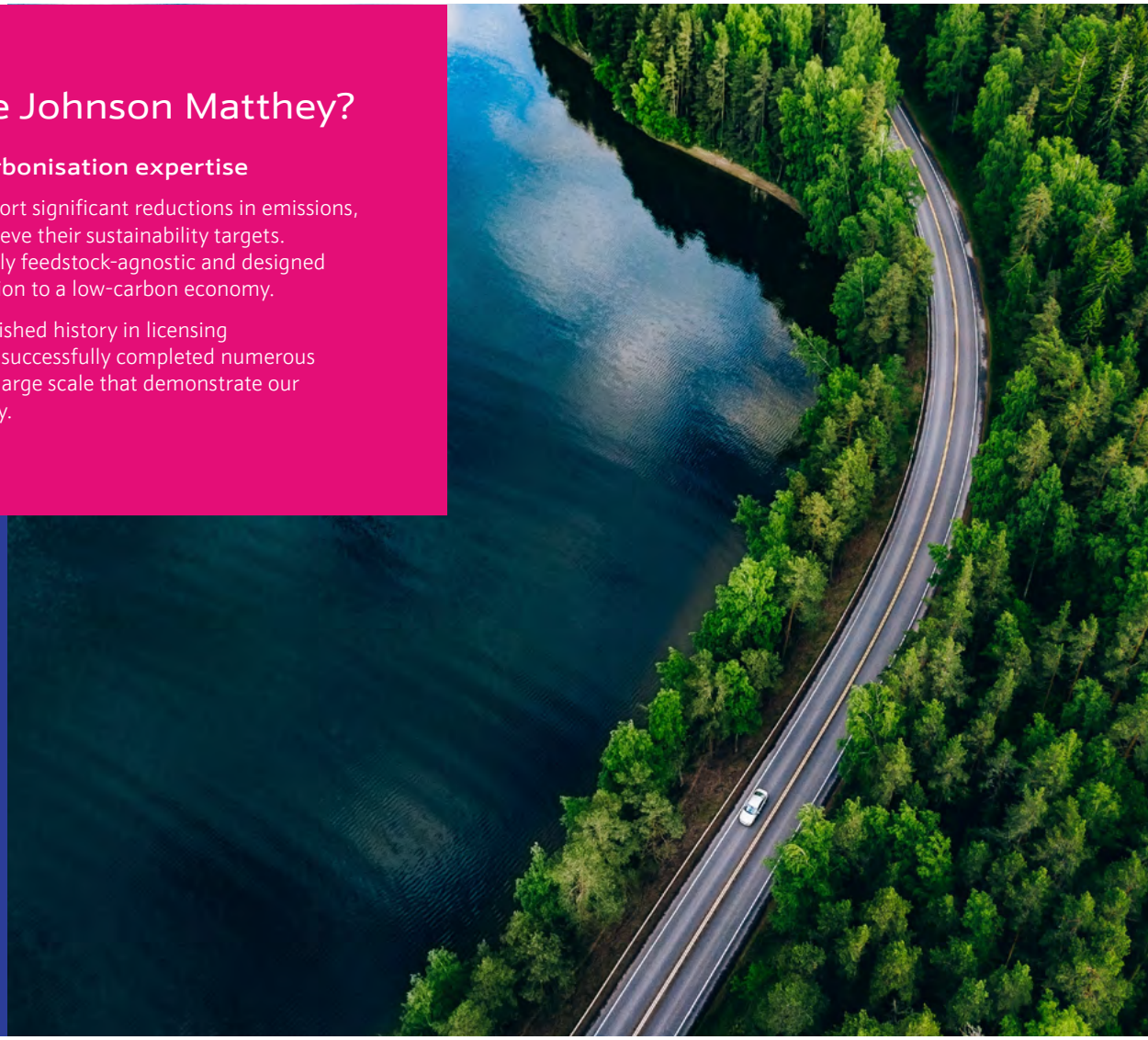
JM is at the forefront of the energy transition. We are committed to building a better and more sustainable future.

Why choose Johnson Matthey?

Unmatched decarbonisation expertise

JM's technologies support significant reductions in emissions, helping industries achieve their sustainability targets. Our solutions are largely feedstock-agnostic and designed to facilitate the transition to a low-carbon economy.

With a long and established history in licensing technologies, we have successfully completed numerous worldwide projects at large scale that demonstrate our expertise and reliability.



How JM is enabling a more sustainable tomorrow

Our technologies are helping to build a better future. Take a look below to see how we are delivering solutions across the value chain.

Sustainable aviation fuel

Sustainable aviation fuels with **FT CANS**™ (co-developed with bp), **HyCOgen**™ together with **FT CANS** and **BioForming**® S2A developed by Virent and JM. SAF can also be produced by the methanol-to-jet process.

Sustainable hydrogen

Award-winning **LCH**™ technology converts natural gas to blue hydrogen with high process efficiency and CO_2 capture.

Low-carbon hydrogen production by retrofitting grey hydrogen plants with JM's **CLEANPACE**™ solution underpinned by **JOHNSON MATTHEY ADVANCED REFORMING**™ technologies.

Sustainable fuels

Renewable DME as a blendstock for LPG.

eSNG or RNG produced as fuels for the gas grid.

Sustainable industrial innovations

Production of sustainable chemicals such as blue ammonia and green methanol.

Unlock global trade of clean hydrogen with JM's ammonia cracking technology.

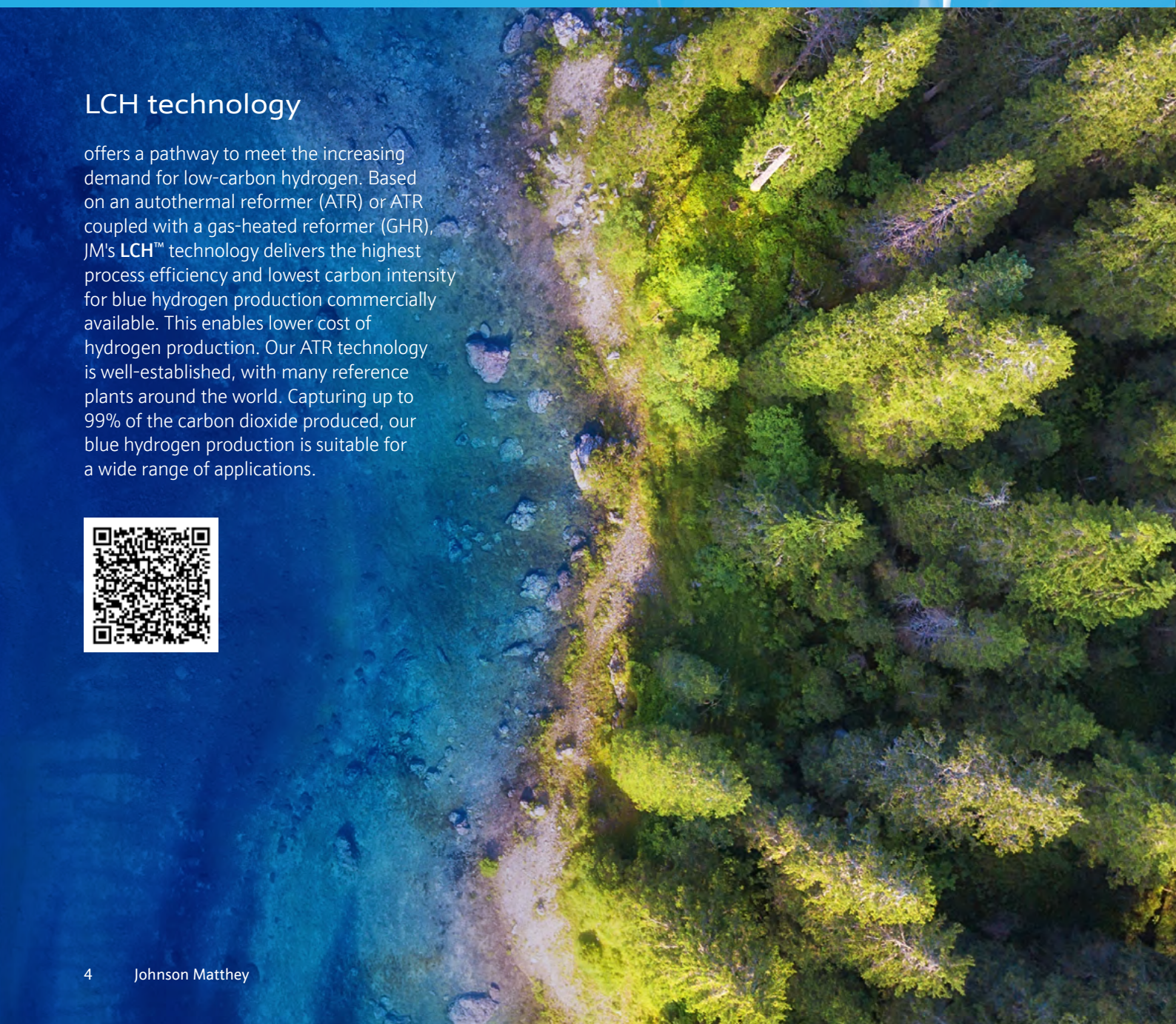
Sustainable marine fuel

Sustainable marine fuel produced by JM's **eMERALD**™ CO_2 to methanol process, **CIRCULAR METHANOL**™, biomass to methanol and JM and thyssenkrupp Uhde's natural gas to low-carbon ammonia process.

Low-carbon hydrogen

Low-carbon hydrogen, produced from natural gas with high carbon capture rates and storage (CCS), is a clean and versatile energy source. Hydrogen produced in this way will play a key role in the path to net zero, both as a zero-carbon fuel and a zero-carbon feedstock for fuels and products.

To maximise its potential, we need to move beyond colours and focus on carbon intensity. Most hydrogen regulatory standards are independent of feedstock or technology and based on the carbon intensity of the hydrogen produced, not the colour.



LCH technology

offers a pathway to meet the increasing demand for low-carbon hydrogen. Based on an autothermal reformer (ATR) or ATR coupled with a gas-heated reformer (GHR), JM's **LCH**™ technology delivers the highest process efficiency and lowest carbon intensity for blue hydrogen production commercially available. This enables lower cost of hydrogen production. Our ATR technology is well-established, with many reference plants around the world. Capturing up to 99% of the carbon dioxide produced, our blue hydrogen production is suitable for a wide range of applications.

Blue ammonia

When low-carbon hydrogen reacts with nitrogen, it is converted into blue ammonia. JM, in partnership with **thyssenkrupp Uhde**, a leading provider of the uhde® ammonia technology, can produce blue ammonia with up to 99% carbon dioxide capture. As well as decarbonising existing ammonia production for example for use in fertilizers, blue ammonia can serve in the following new applications:

- as a practical hydrogen carrier, facilitating the storage and transportation of hydrogen without the challenges associated with shipping pure hydrogen.
- as a shipping fuel to decarbonise the maritime sector.
- as a fuel for power generation.

Ammonia cracking

Clean ammonia can be 'cracked' back into hydrogen for use as a fuel or for power generation. JM offers ammonia cracking technology that is ready for deployment at scale. Our knowledge is based on more than 50 years of catalyst experience of cracking applications and our heritage of over 60 years in steam reforming.

CLEANPACE

JM's **CLEANPACE**™ solution helps decarbonise existing steam methane reformers (SMR) and other fired equipment to achieve emissions reductions of up to 95%.

Underpinned by proven **JOHNSON MATTHEY ADVANCED REFORMING**™ technologies, hydrogen is used for firing together with carbon dioxide capture. Through better scalability, constructability and design flexibility, **CLEANPACE** offers a superior value over post combustion capture technology solutions.

eSNG and RNG

Electrolytic synthetic/substitute natural gas (eSNG, otherwise known as e-methane or e-NG) and renewable natural gas (RNG) are chemically comparable to fossil natural gas. eSNG is produced by reacting green hydrogen with captured CO_2, whilst RNG is produced from gasified biomass.

eSNG and RNG can be blended as a drop-in renewable fuel with full utilisation of existing natural gas and LNG infrastructure, making them a key pillar in the transition to low-carbon footprint fuels.

Sustainable aviation fuel technology

Sustainable aviation fuels (SAF) are considered to be critical to decarbonising the aviation sector.

JM's suite of SAF technologies provide scalable solutions for reducing aviation emissions. Our Fischer Tropsch (FT) technology is commercially deployed and BioForm SAK was successfully used in a commercial airliner.

FT CANS

JM's ASTM approved **FT CANS**™ technology (co-developed with bp) converts syngas produced from waste or biomass into high quality synthetic crude oil suitable to produce renewable diesel, jet fuels or naphtha.

In April 2024, JM announced a licence representing the world's largest SAF production facility using FT technology. This highlights the scalable nature of our technology and the ability to produce 100% SAF.

HyCOgen with FT CANS

JM's **HyCOgen**™ technology converts captured carbon dioxide and green hydrogen into syngas through reverse water gas shift technology. When this process is combined with JM and bp's co-developed, **FT CANS** technology, it turns over 95% of the carbon dioxide into high quality synthetic crude oil for SAF, renewable diesel or naphtha.

BioForming S2A

The **BioForming**® S2A technology, developed by JM and Virent, processes sugar feedstocks to produce BioFormate. This enables the production of a a range of aromatic products including bio gasoline, synthesized aromatic kerosene (BioForm SAK) and chemical products including bio-based benzene and bio-based paraxylene.

This technology was used in Virgin Atlantic's Flight100. This was the world's first transatlantic flight undertaken by a commercial airline, fuelled by 100% SAF. The flight used the aircraft's fuelling infrastructure without any modifications.

Sustainable methanol

The production of sustainable methanol is scaling up, providing a long-term solution to different transport sectors including maritime and aviation. As the world's leading methanol synthesis technology and catalyst supplier, we produce methanol using a range of feedstocks.

eMERALD CO_2 to methanol

In this process, electrolytic hydrogen reacts with bio-based or captured CO_2 to produce methanol. JM's **eMERALD**™ methanol process combines tailored reactor and flowsheet design with our unrivalled **eMERALD** 201 catalyst to maximise efficiency and fully utilse these valuable feedstocks, whilst also minimising the overall energy requirements and operating costs.

JM's **eMERALD** technology is being used in the Haru Oni project in Patagonia, Chile, the world's first methanol plant to harness energy from the wind.

Biomass or waste to methanol

Biomass or waste, including crop residues, and municipal waste, can be used as feedstocks for methanol production. Our **CIRCULAR METHANOL**™ offer uses municipal and industrial waste to produce methanol, combining NextChem MyRechemical's gasification and JM methanol process technology; solutions which are proven, bankable and ready now.

Methanol derivatives

Renewable DME (dimethyl ether)

DME is a clean, colourless non-toxic gas that is easy to liquefy and transport. It can be produced from renewable methanol, including our **eMERALD** solution, and our proven **DAVY**™ DME process technology. As a renewable liquid gas, it is a direct synthetic drop-in blendstock for LPG (propane and butane), and can be used as a fuel in diesel engines.

Methanol-to-jet (MtJ)

SAF can be manufactured using methanol as a feedstock through the methanol-to-jet process. Our **eMERALD** and bio-methanol routes can be integrated with MtJ processes to increase SAF production efficiency.

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