Johnson Matthey's LCH™ technology

Delivering CCS-enabled hydrogen at scale today

Johnson Matthey
Inspiring science, enhancing life

The challenge

- To meet global net zero targets, the world needs an abundant, inexpensive low carbon alternative to fossil fuels
- Industrial clusters require a large and reliable supply of low carbon fuel to commit to switching
- Rapid development of all hydrogen production technologies is required, especially those which can be deployed at scale today

Our solution

- Our **LCH** process is available at scale today
- Our **LCH** technology offers the lowest carbon intensity in the market, meeting low carbon standards and gaining access to low carbon hydrogen subsidies
- Our **LCH** technology is proven, having been selected for numerous projects including the UK's HyNet industrial cluster
- JM offers speed and value via end-to-end solution including flowsheet development, process design package, catalyst supply and proprietary equipment supply

Low carbon hydrogen:
The answer to achieving net zero

Achieving net zero will be a phenomenal task. As governments, policy makers and industry leaders rally to accelerate the energy transition, low carbon hydrogen will be critical in making the world's transition toward clean energy possible. It is very effective for decarbonisation in many industries, either to decarbonise applications which cannot be electrified, or as an alternate energy carrier, for large-scale long-term energy storage. To realise these applications – the world needs a large and stable supply of low carbon hydrogen today.

CCS-enabled (blue) hydrogen is fuel produced from natural gas where the associated carbon dioxide (CO_2) is captured, rather than emitted into the atmosphere. Not all blue hydrogen is created equal, however. Our decades of experience means that we can provide the most optimised and efficient process available for the production of low carbon hydrogen, providing our customers with the lowest levelised cost of hydrogen and the possibility of carbon capture rates over 99%.

Johnson Matthey's (JM's) award winning **LCH™** technology utilises less natural gas feedstock, produces less carbon dioxide, and offers improved scalability when compared to other low carbon hydrogen production routes. With our technology, the world can realise its goals for a more sustainable future.

Our vision is to meet future energy needs while creating a more sustainable world

At Johnson Matthey, our technologies deliver ever more efficient and sustainable ways to make products and fuels used all over the world, and at the heart of our expertise in Catalyst Technologies (CT) is syngas. We draw on this expertise in syngas process design, licensing, and catalysis to create technologies that will decarbonise the hardest-to-abate sectors. Our technologies enable the production of clean hydrogen for use in the steelmaking or petrochemicals industries and make sustainable aviation fuels and power-to-x technologies a reality.

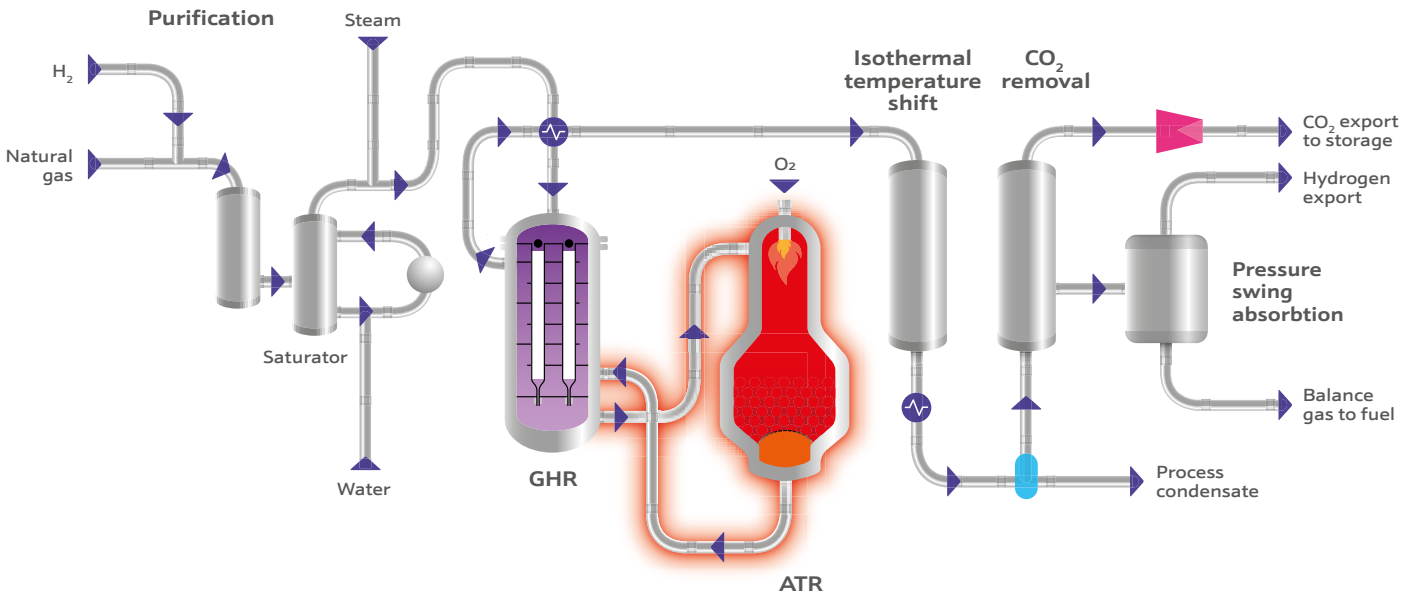
An incredible challenge like the one posed by net zero needs the best available technology. JM's advanced reforming technology offers the most efficient means of low carbon hydrogen production available when it comes to feedstock usage, carbon capture rates, carbon footprint, and CO_2 generation. It also outperforms more conventional production methods, such as steam methane reformers (SMR). Our innovative technology relies on our award-winning advanced reforming flow sheets delivering the CO_2 in a high pressure, high concentration process stream, a key advantage over SMR based flowsheets. The CO_2 can then be easily removed via conventional carbon capture methods.

By using gas heated reforming and autothermal reforming we can achieve temperatures over 1000 °C, giving unparalleled hydrocarbon conversion. The energy to drive the reaction comes by introducing oxygen (O_2) to the Autothermal Reformer (ATR) rather than the combustion of natural gas, reducing the overall carbon intensity of the process.

The GHR gives an efficiency advantage over ATR-only flowsheets as high-grade heat from the ATR is conserved and used to drive the initial reforming reaction. This is key to achieving a low carbon intensity and the most efficient feedstock utilisation. Combustion is minimised and thermal gradients are reduced.

The **LCH** process is a combination of proven technologies that JM has applied in the hydrogen, methanol, and ammonia industries for many years. The Autothermal Reformer, Gas Heated Reformer, Isothermal Shift converter, and saturator units have all been demonstrated at commercial scale across several operating plants.

How our award-winning technology works



Partner with JM for the best available technology

JM's **LCH** process has a carbon intensity half that of the recent UK's low carbon hydrogen standard. As the lowest possible carbon intensity process, **LCH** enables maximising economic incentives from USA IRA and is positioned to achieve low hydrogen carbon standards across the globe.

	SMR + CCS	JM LCH ATR only	JM LCH GHR - ATR
Natural Gas Energy Requirement (LHV)	432 MW	402MW ↓	373 MW ↓
Process Carbon Intensity	100% 90% capture	27% 97% capture ↓	24% 97% capture ↓
Relative CapEx	100%	74% ↓	61% ↓

Compared to SMR, the LCH process offers:

- Increased carbon capture rates
- Significantly less carbon intensity
- 10% less feedstock used
- 10% less CO_2 produced
- 75% lower CapEx

*This is for a particular comparative study.

JM's award-winning technology is at the heart of the transition to net zero

JM's **LCH** technology is central to HyNet, the UK's leading industrial decarbonisation project, delivering low cost and low carbon hydrogen.

Our **LCH** flowsheet has been chosen for its ability to deliver low carbon hydrogen at scale and with high efficiency. The plant, which meets specific regional design demands, will represent the UK's first low carbon hydrogen plant, and provide a foundation reference for replication across the UK and internationally.

The HyNet low carbon hydrogen plant, which utilises JM's **LCH** technology, will produce 3TWh of low carbon hydrogen – double the UK's current production of biomethane. With 97% of the carbon used in the process captured and stored, the facility will deliver efficient and low-cost fuel industrially and domestically while paving the way toward net zero.

HyNet North West

Scan the QR code to learn more about JM and HyNet's partnership

At Johnson Matthey we have a 205-year history of overcoming the most complex technological challenges through innovative solutions such as the developing and licensing of world class technologies within CT (Catalyst Technologies).

Our core capabilities

- Process licensing – sold over 100 licenses in the past 20 years
- Syngas expertise with over 100 reforming plants designed
- Computational modelling and chemical engineering for first principles flowsheet development - optimising manufacturing and process routes
- High performance catalyst production

JM Johnson Matthey
Inspiring science, enhancing life

Find out more about LCH and the environmental credentials of your project, visit our webpage