Catalyst Technologies seminar:
Enabling the net zero transition

27th June 2023
Cautionary statement

This presentation contains forward-looking statements that are subject to risk factors associated with, amongst other things, the economic and business circumstances occurring from time to time in the countries and sectors in which Johnson Matthey operates. By their nature, forward-looking statements involve uncertainty because they depend on future circumstances, and relate to events, not all of which are within Johnson Matthey's control or can be predicted by Johnson Matthey. It is believed that the expectations reflected in these statements are reasonable but they may be affected by a wide range of variables which could cause actual results to differ materially from those currently anticipated and you should therefore not place reliance on any forward-looking statements made. No part of this presentation constitutes, or shall be taken to constitute, an invitation or inducement to invest in Johnson Matthey or any other entity, and must not be relied upon in any way in connection with any investment decision. Johnson Matthey undertakes no obligation to update forward-looking statements contained in this document or any other forward-looking statement it may make.
01. Introduction

Liam Condon
Chief Executive
Catalysing the net zero transition

Our aspiration is to lead across our four businesses

Clean Air
Leading in autocatalyst markets

Catalyst Technologies
#1 in syngas-based chemicals and fuels technology

Hydrogen Technologies
Market leader in performance components for fuel cells and electrolysers

PGM Services (Platinum Group Metals Services)
#1 recycler of PGMs

1. Iridium, palladium, platinum, rhodium and ruthenium.
Portfolio transitioning and growing over time

Accelerating to high single digit growth\(^1\) over the medium term, and strong long-term growth

Beyond 2030, growth businesses expected to be bigger than the size of JM today...

Illustrative chart
Development of underlying operating profit

Structural growth markets accelerating and opportunities are larger than previously expected

1. At constant precious metal prices and FX rates (2021/22 average). Note: Illustration excludes Value Businesses and Corporate.
Catalyst Technologies is a key pillar of our strategy

Key pillar of our strategy – key growth driver as we catalyse the net zero transition

Catalyst Technologies and Hydrogen Technologies span the hydrogen value chain and underpin the transition to sustainable fuels

Shared expertise in metal catalysis, leveraging capabilities and assets in our R&D centres

Increasingly important connectivity with PGM Services as the world transitions to net zero
02. Catalyst Technologies
Today’s agenda

01. Catalyst Technologies overview
02. Energy transition and regulatory drivers
03. Syngas is a key gateway to growth opportunities
04. Sustainable fuels
05. Low carbon hydrogen (blue hydrogen)
Catalyst Technologies is a global leader in licensing process technology and supply of catalysts

2022/23 sales

£560m

c.10% licensing

c.90% catalyst

Leading provider of process technology, which CT licences to customers, and catalysts¹

Leading market position in syngas

Trusted 20+ year customer and partner relationships

Driving significant shift towards licensing over time

Sustainable solutions driving growth and value creation

Note: CT – Catalyst Technologies. Syngas is predominantly carbon monoxide (CO), carbon dioxide (CO₂) and hydrogen (H₂).

¹. As well as licensing, CT may also provide proprietary equipment to customers which complements our proprietary technologies.
JM offers an attractive combination of licensing and catalysts to optimise our customers’ performance

**Licensing**
Process technology and engineering services to enable efficient, sustainable chemical processes

**Catalysts**
Fundamental to chemical processes, increasing plant efficiency, product yield and sustainability

A differentiated customer offering
The energy transition creates significant new opportunities

1. There is an urgent need for the world to decarbonise...

2. Driving strong demand for hydrogen and sustainable fuels

3. Hydrogen is essential for:
   - Decarbonising hard to abate industrial processes
   - Building blocks for sustainable fuels and chemicals
   - Balancing power grids in an increasingly renewable world

Focus of today’s seminar

1. Chemicals – end market size for JM relevant chemicals (various market reports).
2. Energy – revenue of top 250 oil and gas players (excluding utilities).
Regulatory environment and incentives support low carbon hydrogen demand

<table>
<thead>
<tr>
<th>Region</th>
<th>Key Points</th>
</tr>
</thead>
</table>
| **US** | **Inflation Reduction Act** – c. US$370bn clean energy incentives  
Tax credits for low carbon hydrogen projects |
| **EU** | Legislation puts **renewable and low carbon hydrogen on equal footing** in terms of CO₂ reduction required |
| **China** | **First long-term plan for hydrogen** promoting hydrogen production, infrastructure development and use |
| **UK** | **10GW of low carbon and electrolytic hydrogen production capacity by 2030** |
| **Middle East** | **Kingdom of Saudi Arabia:**  
2.9 million tonnes of low carbon and electrolytic hydrogen by 2030,  
4 million tonnes by 2035 |
| **Japan** | Target of **12 mt pa hydrogen supply by 2040** (6x today) supported by c.$110bn investment |


Note: Low carbon hydrogen refers to CCS-enabled hydrogen / blue hydrogen.
Regulatory environment, incentives and customer commitments support sustainable fuels demand

<table>
<thead>
<tr>
<th>Policy drivers</th>
<th>EU</th>
<th>Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>US</strong></td>
<td><strong>Inflation Reduction Act</strong> – c.US$370bn clean energy incentives</td>
<td><strong>SAF mandate</strong> of minimum 10% SAF by 2030</td>
</tr>
<tr>
<td></td>
<td><strong>Grand SAF Challenge:</strong> 3bn gallons/yr (c. 10% SAF) by 2030, 100% by 2050</td>
<td><strong>Japan:</strong> target of 10% SAF by 2030</td>
</tr>
<tr>
<td><strong>EU</strong></td>
<td><strong>REFuelEU Aviation SAF mandates</strong> minimum 6% SAF in 2030 and 70% by 2050</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>RED III target</strong> for 5.5% advanced biofuels plus renewable fuels of non-biological origin by 2030</td>
<td></td>
</tr>
</tbody>
</table>

**End customer drivers**

25 airlines covering 35% of global traffic have committed to SAF blend by 2030 – including KLM, Air France, American Airlines, Delta, DHL, Quantas, Japan Airlines

Source: US Department of Energy, European Commission, UK Department for Transport, IATA, Nikkei Asia, company websites.
We are moving from breaking down long hydrocarbon chains...

...to building up short hydrocarbon chains through syngas to create sustainable fuels.
Leading market positions in syngas and building partnerships for the future

<table>
<thead>
<tr>
<th>Syngas processes</th>
<th>Global segment position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>#1</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>#1</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>#1</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Top 3</td>
</tr>
</tbody>
</table>

**Example customers and partners**

Building alliances and partnerships are increasingly important for go-to-market

*Note: Segment position refers to JM position in catalyst. Based on JM’s market database.*
JM is one of the few players in syngas with an integrated offer

Key players in syngas¹

JM’s integrated catalyst and licensing offer delivers:

- Strong value proposition through combination of process design and catalyst
- Security of catalyst supply in a growing market
- Long lasting customer relationships
- Strong recurring sales
- Fast route to market for new technologies

¹ Not exhaustive. Includes hydrogen, methanol, ammonia, formaldehyde.
Winning early projects and a large pipeline

Won five projects worth c.£120m sales¹

Low carbon hydrogen

1. Equinor and Linde for H2H Saltend – one of the UK’s largest low carbon hydrogen projects
2. A large scale low carbon hydrogen project in North America

Sustainable fuels

3. Strategic Biofuels project in North America – carbon negative renewable diesel
4. Waste-to-fuels project in North America
5. Waste-to-fuels project in Europe

Pipeline of more than 100 sustainable solution projects² (compared to 70 projects a year ago)

1. Revenue over 5 years relating to low carbon hydrogen and sustainable fuel project wins from 1st April 2022 to date, assuming project completion.
2. Sustainable solutions pipeline includes low carbon hydrogen, sustainable fuels and low carbon solutions projects.
Today’s main pathway to sustainable aviation fuel is feedstock limited

1. **Today’s pathway**
   Oil and fat derivatives (HVO and HEFA¹)

2. **Feedstock**
   Plant and animal fats, oils and greases (e.g. waste cooking oil), oils from specially grown crops

3. **But HEFA/HVO is feedstock limited long term...**
   HEFA/HVO limited by feedstock availability²

---

1. HEFA – Hydroprocessed Esters and Fatty Acids; HVO – Hydrogenated Vegetable Oil.
2. World Economic Forum – Clean Skies for Tomorrow 2020; IATA.
JM plays in three of the main growth pathways for sustainable aviation fuel production

### Growth pathways

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Partner</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syngas produced from waste or biomass</td>
<td>bp</td>
<td>JM</td>
</tr>
<tr>
<td>Green hydrogen with captured CO₂</td>
<td>bp</td>
<td>JM</td>
</tr>
<tr>
<td>Sugars from biomass</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fischer-Tropsch (FT CANS™)</th>
<th>E-fuels (via Fischer-Tropsch or methanol)</th>
<th>BioForming™ (pathway to 100% SAF blend)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JM / bp collaboration on FT route only</td>
<td></td>
<td>wholly owned subsidiary of Marathon</td>
</tr>
</tbody>
</table>

Note: Fischer-Tropsch FT CANS™ technology is proprietary to JM and bp.
Sustainable aviation fuel: strong competitive advantage

Market leader in syngas

First mover advantage

Proven technologies, existing customers

Expertise in deploying world scale plants

Technologies offer access to broad range of feedstocks (waste, biomass, hydrogen)

- **FT CANS™**: 50% reduction in capex\(^1\), modular development
- **E-fuels**: technology provider for world’s first climate neutral e-methanol plant – Haru Oni
- **BioForming™**: enabled first flight using 100% SAF

Current pipeline of >65 projects

---

1. Compared to conventional fixed-bed Fischer-Tropsch technology.
Converting forestry waste into renewable diesel with negative carbon footprint

**Gasification**
Process to convert carbon based raw materials into syngas

**Syngas**
JM’s FT CANSTM technology, jointly developed with bp, efficiently converts syngas into a sustainable synthetic crude

**Upgrading**
Process to refine synthetic crude into fuel

**Sustainable fuel**

**Woody biomass**

**Biomass**

Note: Syngas is predominantly carbon monoxide (CO), carbon dioxide (CO₂) and hydrogen (H₂). Synthetic crude is a mixture of hydrocarbons produced in the Fischer-Tropsch process.
Main pathways to low carbon hydrogen production

**Traditional method of producing hydrogen from natural gas**
- Mature technology
- High capital cost to capture required CO\(_2\)

**Steam methane reforming (SMR)**

**JM’s LCH™ technology**

- **Mature technology**
- Higher CO\(_2\) capture at lower capex compared to SMR
- Exceeds current standards for carbon intensity to be classified as low carbon hydrogen

**Autothermal reforming (ATR)**
- Higher feedstock efficiency\(^1\)
- Lower carbon intensity\(^1\)
- Exceeds current standards for carbon intensity to be classified as low carbon hydrogen

**Autothermal reforming (ATR) and gas heated reforming (GHR)**

---

1. Compared to ATR technology. Based on JM data.
Low carbon hydrogen: strong competitive advantage

Market leader in syngas

Expertise in deploying world scale plants

Existing customers

Portfolio of proven technologies to meet different customer needs

ATR: world-class uptimes

ATR-GHR:
  • Up to 99% CO$_2$ capture$^1$
  • 12% lower capex and 7% lower feedstock usage$^2$

1. Based on JM data.
2. Compared to conventional ATR technology. Based on JM data.
JM signed low carbon hydrogen technology licence with Equinor and Linde Engineering for H2H Saltend, one of the UK’s largest low carbon hydrogen projects

JM’s LCH™ technology efficiently converts natural gas into hydrogen, with the by-product CO₂ captured and safely stored, reducing CO₂ emissions by more than 95%

Decarbonising chemicals and electricity production in the Humber region – the UK’s most carbon intensive industrial region

H2H Saltend: low carbon hydrogen project
Our priorities

1. Delivering on short-term performance and driving improved margins
2. Winning new business across our sustainable solutions portfolio
3. Scaling our commercial and engineering capacity
4. Accelerating the net zero transition through more strategic partnerships
03. Financials
**Significant incremental revenue pool from two growth opportunities**

**Sustainable aviation fuel**
- Cumulative 2030 TAM: c.£4bn²
- Projects required by 2030 to meet market demand³: c.145

**Low carbon hydrogen**
- Cumulative 2030 TAM: c.£2.5bn²
- Projects required by 2030 to meet market demand³: c.125

---

1. Value of total addressable market calculated as the first 5 years of revenue from the cumulative number of projects needed to meet the market demand. Excludes other sustainable fuel opportunities such as BioForming, e-methanol and ammonia cracking.
2. Addressable market for Sustainable Fuels based on IATA data for Sustainable Aviation Fuels (SAF) with an assumption of 25% of SAF demand via FT-based routes by 2034. Addressable market for Low Carbon Hydrogen based on demand according to IEA APS (blue hydrogen).
3. Based on the cumulative number of projects needed to meet addressable demand by 2034 (following an average 4 years to plant start up). Sustainable aviation fuel: 15mTpa (120m barrels p.a.). Low Carbon Hydrogen: 20mTpa (70k MW p.a.).
Driving sales towards licensing

Licensing / catalyst mix expected to change materially
- Net zero transition driving long-term investment cycle
- Significant investment in new plants driving licensing income
- JM has a licensing led business model

Revenue spread over a number of years

Average JM revenue per existing project within first 5 years (£20-30m)
- Licensing: c.£10m (Process technology and engineering)
- First fill catalysts: c.£10-20m (Catalyst fills for new build plants)

Every 3-4 years
- Refill catalysts: c.£10-20m (Catalyst refills for existing plants)

1. 2030+ total sales and split is illustrative. Licensing includes engineering and licence of process technologies and associated revenues.
2. Average revenue for licensing, engineering and first fill catalysts over the first 5 years for a typical sized project.
3. Average revenue for each refill catalyst beyond the first 5 years. Based on an assumed 3-4 year refill cycle.
Improving operating margin

Creating a stronger platform for growth

Pricing initiatives
- Surcharges to recover cost inflation
- Driving value-based pricing in key segments
- Focus on strengthening pricing capabilities

Procurement
- Reducing number of suppliers by one third
- Reducing reliance on single source items
- Introducing alternative raw materials

Manufacturing efficiency
- Manufacturing excellence initiatives
- Increasing capacity in key sites

Licensing / catalyst mix
- Licensing is a higher margin, low capex business model
- Sustainable solutions growth shifts mix towards licensing, driving margin accretion
Delivering **high single digit sales growth** in the **short-term**, accelerating to **mid teens sales growth** over the **medium to long-term**

Margin accretion driven by value creation programme and mix shift towards licensing
- **Mid teens** margin within **two years** (by end of 2024/25)
- **High teens** margin within **five years** (by end of 2027/28)
- **Continued margin accretion** over the long-term driven by licensing shift

**Depreciation and amortisation** – c.5% of sales

**Capex**
- High single digit capex to sales in 2022/23
- Decreasing capital intensity over time with increased licensing in the mix

**Working capital requirements**
Improves as the business shifts more towards licensing
04. Conclusion

Liam Condon
Chief Executive
We have clear milestones in Catalyst Technologies

### Strategic

- Win at least 4 large scale projects in 2023/24

### Financial

- Deliver targeted capacity expansion (formaldehyde catalyst) by end of 2023/24
- Delivering high single digit sales growth in the short-term, accelerating to mid teens sales growth over the medium to long-term
- Mid-teens margin within the next two years (by end of 2024/25)
- High teens margin within the next five years (by end of 2027/28)
- Continued margin accretion over the long-term driven by licensing shift

1. Won one sustainable fuels project so far in 2023/24.
Catalyst Technologies is enabling the net zero transition.

01. Deliver on financial commitments
02. Achieve all strategic milestones
03. Accelerate the net zero transition through more strategic partnerships
## Total addressable market (TAM) demand to 2030

<table>
<thead>
<tr>
<th>Growth markets</th>
<th>Number of projects required by 2030 to meet market demand</th>
<th>Data sources and assumptions</th>
<th>JM revenue per project&lt;sup&gt;4&lt;/sup&gt; £m</th>
<th>Cumulative 2030 TAM&lt;sup&gt;5&lt;/sup&gt; £bn</th>
<th>Number of current projects in JM pipeline</th>
</tr>
</thead>
</table>
| **Low carbon (blue) hydrogen**<sup>2</sup> | May 2022 70-430 | • Scenario range: IEA SDS to IEA NZE  
• Average project size: 160kT/600MW p.a  
• 3 years from project signing to plant start up  
• Addressable demand taken from 2033 | 15-20 | 1-8 | >35 |
| | June 2023 c.125 | • Scenario: IEA APS (Announced Pledges)  
• Average project size: 160kT/ 600MW p.a  
• 4 years from project signing to plant start up  
• Addressable demand taken from 2034 | 15-25 | 2.5 | >35 |
| **Sustainable aviation fuels**<sup>3</sup> | May 2022 30-60 | • Scenario: IATA for SAF with 32% via FT-route  
• Average project size: 3k bpd  
(3k bpd with 75% of plant output = SAF)  
• 3 years from project signing to plant start up  
• Addressable demand taken from 2033 | 20-35 | 1-2 | >25 |
| | June 2023 c.145 | • Scenario: IATA for SAF with 25% via FT-route  
• Average project size: 2.25k bpd  
(3k bpd with 75% of plant output = SAF)  
• 4 years from project signing to plant start up  
• Addressable demand taken from 2034 | 20-40 | 4 | >65 |

1. Based on number projects needed to meet addressable demand by 2034 (following an average 4 years to plant start up). Sustainable aviation fuels: 15m tons p.a or 120m barrels p.a. Low Carbon Hydrogen: 26m tons p.a or 70k MW p.a.  
2. Only natural gas based blue hydrogen.  
3. Only FT-based routes for SAF (excludes alternative technology routes).  
4. Includes engineering, licensing and first catalyst fill.  
5. Value of total addressable market calculated as the first 5 years of revenue (average of range shown) from the number of projects needed to meet the market demand. Excludes other sustainable fuel opportunities such as Virent (Bioforming), e-methanol and ammonia cracking.