



**Johnson Matthey**  
Inspiring science, enhancing life

## Enabling efficient Power-to-X transformations for sustainable fuels and chemicals

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A young girl with blonde hair tied in a ponytail with a yellow bow, wearing a yellow dress, is looking up at a large fish in an aquarium. The fish is a large, silver, flat fish, possibly a surgeonfish, swimming in clear water. The background is a blue wall with some yellow fish visible in the distance.

# Presentation outline

JM

01

**Johnson Matthey's strategy for a cleaner, healthier world**

02

**Green hydrogen routes for sustainable fuels and low carbon land-based energy systems**

03

**Maximising efficiency and reducing risk for highest return on renewable assets**

04

**CO<sub>2</sub>-to-methanol: commercially available, scalable and proven process**

05

**Key takeaways**



# Our strategy: Catalysing the net zero transition for our customers

## Automotive



**1.8-3.0m**

new sales of fuel cell heavy duty  
and light duty vehicles in 2030

## Chemicals



**c.30%**

decrease in emission intensity  
by 2030 to reach net zero path  
in chemicals production

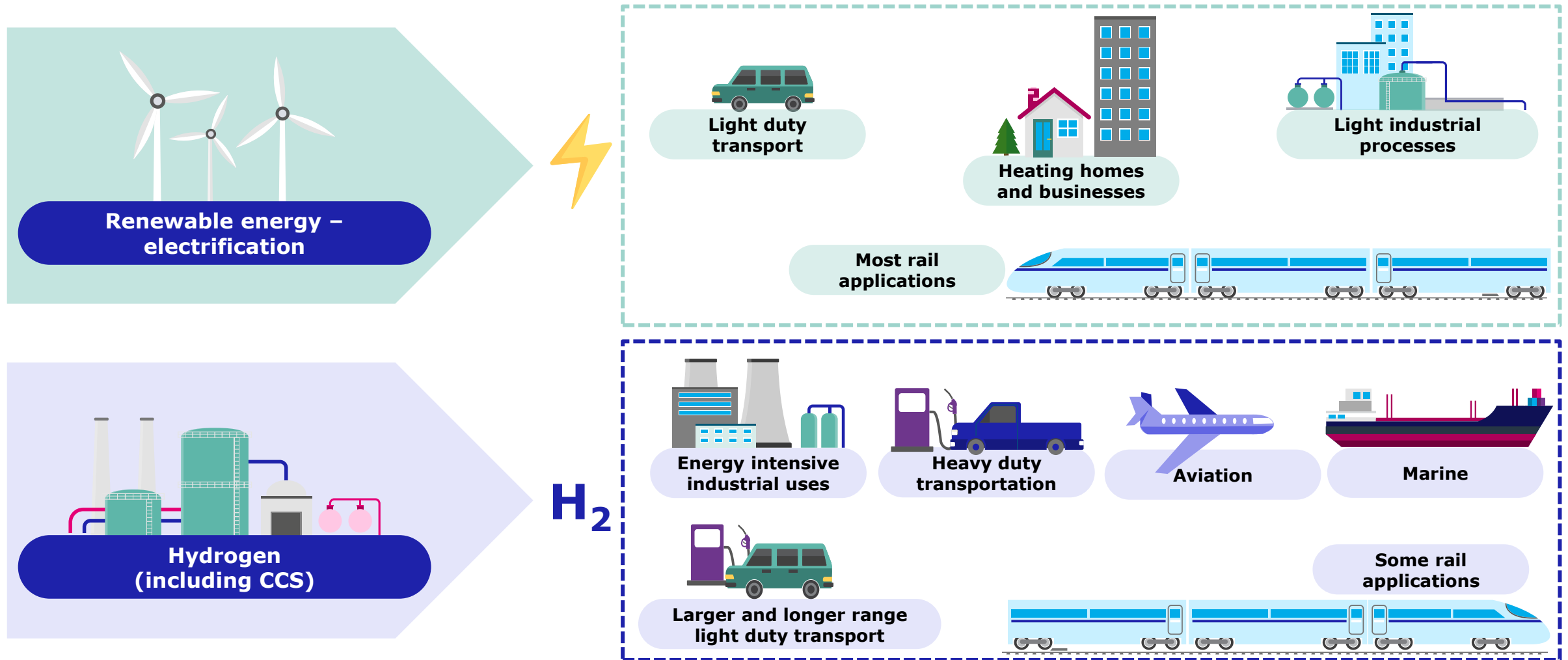
## Energy



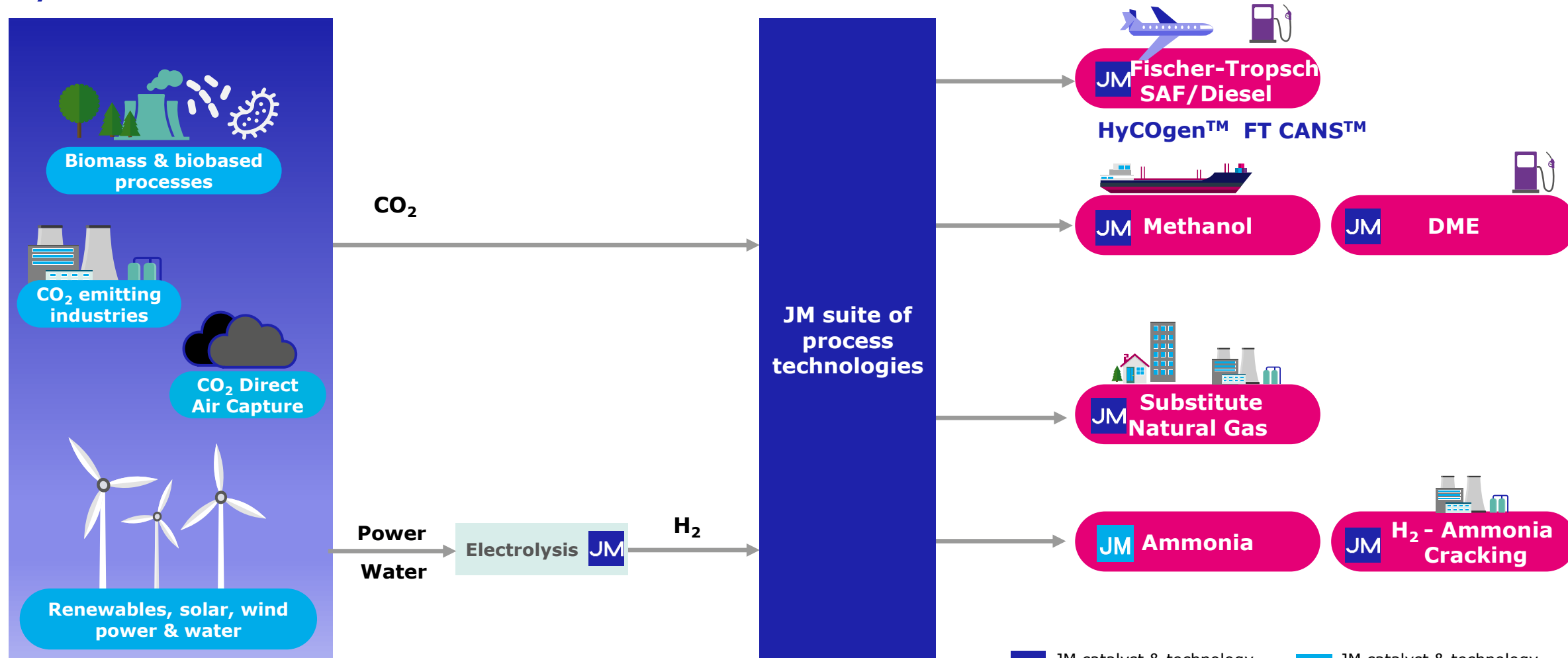
**7 to 9x**

increase in sustainable fuels  
demand by 2040

# Hydrogen is key to reaching “net zero” - Cost effective replacement for fossil fuels, to enable decarbonisation of industry, transport and heat



# JM is enabling production of sustainable fuels for the difficult to decarbonise sectors including aviation, marine and land-based energy systems





# JM is enabling power-to-X project developers to strengthen their business case since 2011

## Technology

**Proven** and **bankable technologies**

Operating references at a range of scales **minimising risk**



## Project Execution

**Minimising DEVEX** during feasibility and permitting stages

**Optimised timelines** and technical oversight to COD



## Operational Risk

Maintaining **long term performance**

Understanding performance impacts of **flexible operations**



## Business Case

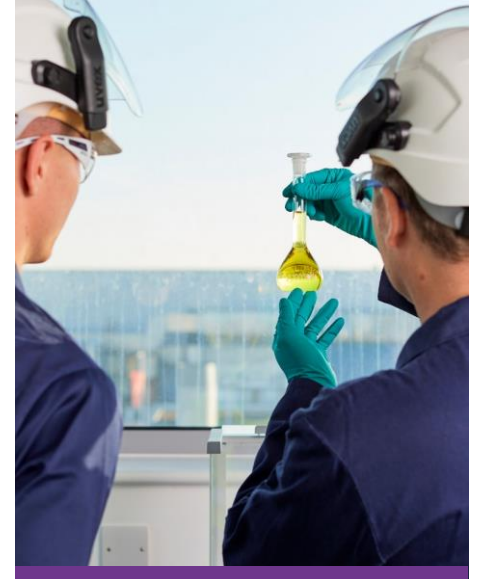
Understanding levers to **balance CAPEX and OPEX**

Maximising H<sub>2</sub> and CO<sub>2</sub> conversion to **minimize OPEX**



## Commercial

Providing insight into **product requirements and specifications** for different end markets



# Sustainable fuels: Siemens Energy Haru Oni e-fuels project

Project details		Purpose	JM role
Pilot Phase:	2022	Demonstrate technology for world's <b>first large-scale commercial plant producing climate neutral methanol and gasoline</b> from green hydrogen and CO <sub>2</sub> recovered by direct air capture	The project is being developed by Siemens Energy in partnership with JM and other major corporations including Porsche and MAN  JM will license methanol technology and supply the engineering, catalyst and equipment for the project
Technology:	JM licensed methanol technology		
Product:	Sustainable fuels (methanol and gasoline)		
Uses:	Transportation fuel		

900,000 litres of sustainable methanol produced per year as early as 2022, growing by 2024 to 55 million litres of sustainable fuels and by 2026 to... **c.550 million litres**

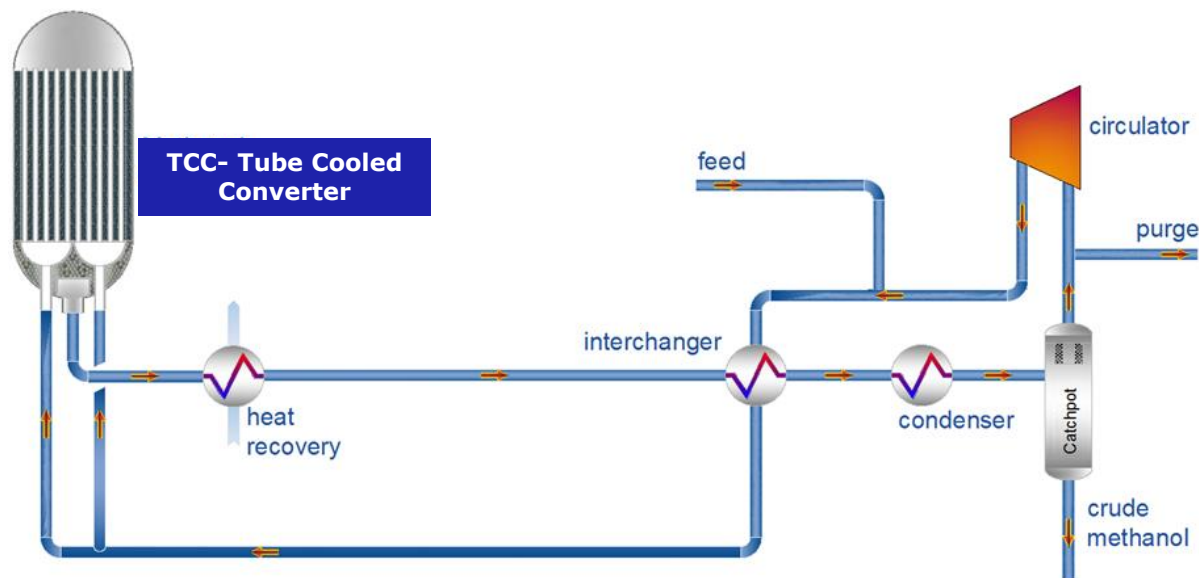




Methanol  
synthesis unit



# JM's CO<sub>2</sub> to methanol: commercially proven, low risk and offering high H<sub>2</sub> efficiency to support a strong business case



**JM first to commercialise CO<sub>2</sub> to methanol technology in 2011**

**Range of solutions** to reduce CAPEX and optimise OPEX based on customer needs

JM methanol converters suited for **high circulation ratios** ensuring **high feedstock efficiency**

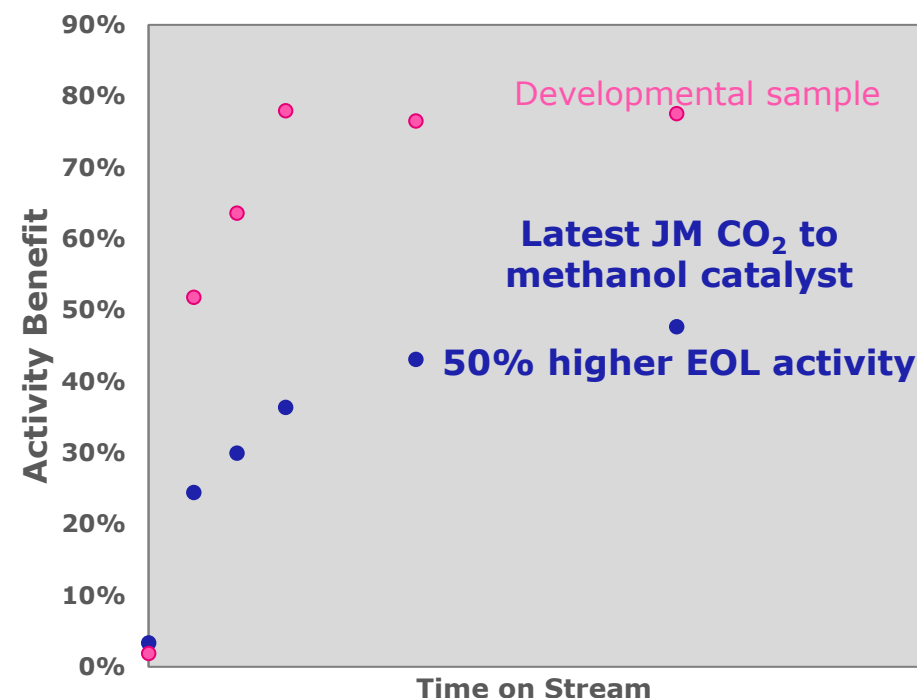
Dedicated services for **plant and catalyst performance monitoring** to best manage plant turnarounds

INDICATIVE PERFORMANCE*	Value
Hydrogen loop efficiency	~99%
Carbon loop efficiency	~99%
Electric Power	~450 kWh/te
Cooling water	~140 te/te

# Highly stable JM catalyst achieves high methanol productivity over a significantly longer lifetime



**JM's latest commercially available catalyst offers a guaranteed lifetime of 4 years**



- Continuous investment in R&D targets even longer life times and sustained high MeOH make



A photograph of an airplane wing, likely from a commercial jet, extending from the left side of the frame towards the center. The wing is white and shows various structural details like flaps and ailerons. The background is a dramatic sunset sky with a bright sun low on the horizon, creating a lens flare and casting a warm orange and yellow glow. The horizon line is visible, separating the dark blue ocean from the sky.

# Johnson Matthey's **HyCOgen™** and **FT CANS™** technologies selected for Repsol and Aramco's synthetic fuel plant in Bilbao

- The plant will be one of the world's first to use **renewable (green) hydrogen** and **CO<sub>2</sub>**
- Due to be commissioned in 2024, with a starting capacity of more than 2,100 tonnes per year
- Production of a sustainable synthetic drop-in fuel that can be blended for existing road vehicle engines, planes and ships.

**Coupling JM's HyCOgen and FT CANS technologies provides an end-to-end, scalable process optimized for high conversion efficiency - enabling the production of premium quality synthetic crude oil.**



## Key takeaways

01

Green H<sub>2</sub> routes to fuels are key to decarbonise marine, aviation & land based energy systems

02

Feedstock efficiency, low technology risk, optimised project execution are key

03

JM has got proven technology deployed in pioneering projects

04

JM's technology leadership can guarantee efficient e-fuels transformations

**JM is a recognised leader in the syngas value chain and a key partner for successful Power-to-X project development**



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