A colourful journey towards low carbon methanol

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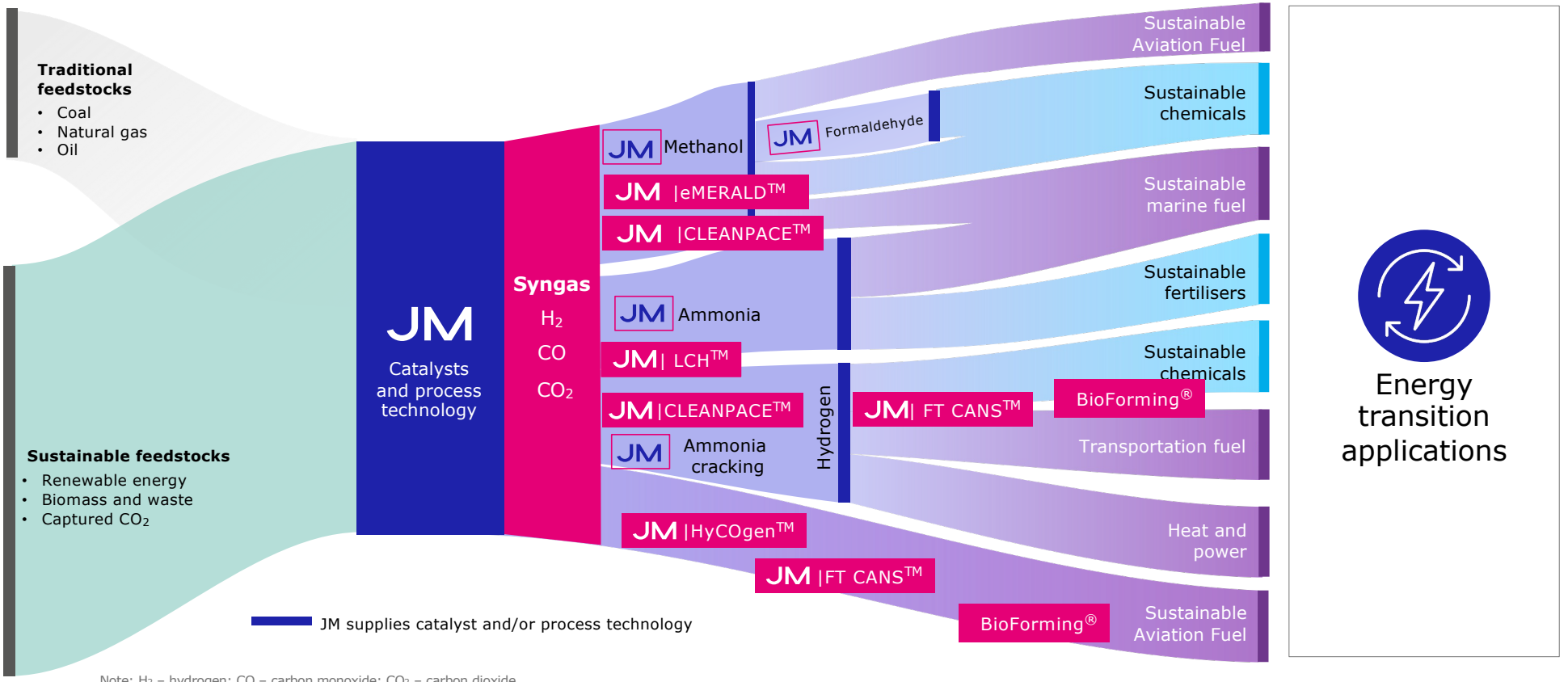
JM is uniquely positioned across the value chain to **decarbonise through syngas**



Note: H_2 – hydrogen; CO – carbon monoxide; CO_2 – carbon dioxide.
LCS – Low carbon solutions; FT CANS™ – Fischer-Tropsch CANS.
FT CANS™ in collaboration with bp.
BioForming® is a trademark of Virent Inc.

JM

JM: the world's leading methanol technology and catalyst supplier, spearheading low-carbon methanol technology deployment

- We are **passionate** about **methanol** and are proud to offer the **most efficient** and **reliable** flowsheets in the market.
- **1st CO_2 to methanol plant in 2011- Leading** the transition to **sustainable (green) methanol**
- We supply the **next-generation** catalysts, with **high activity** and **extended life**
- We have unique **insights** into the global methanol **market**
- We maintain strong, **long-standing partnerships** with the world's largest methanol producers

Global commercial licensing & project execution experience

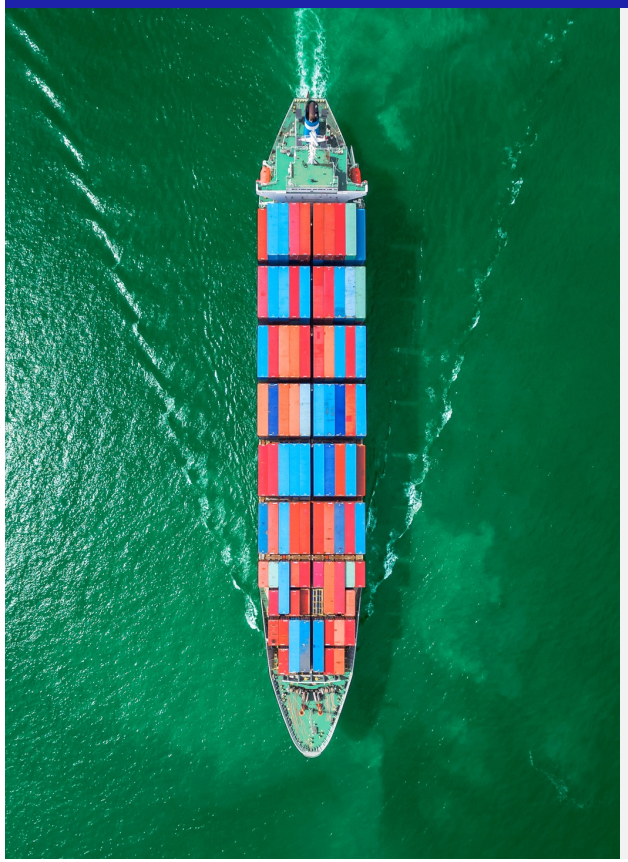
#1
in licensed capacity and installed catalyst

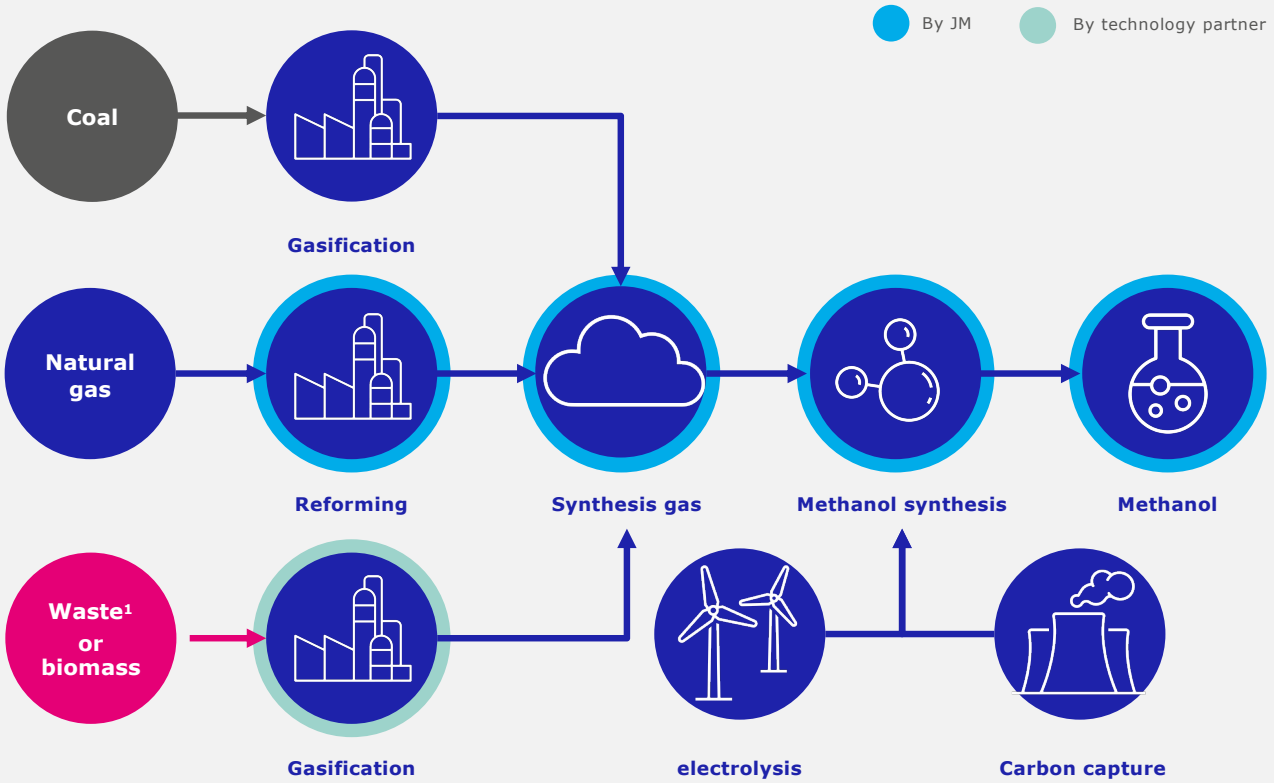
100+
licenses in

35
countries

60M
t/y licensed methanol production

Routes to methanol



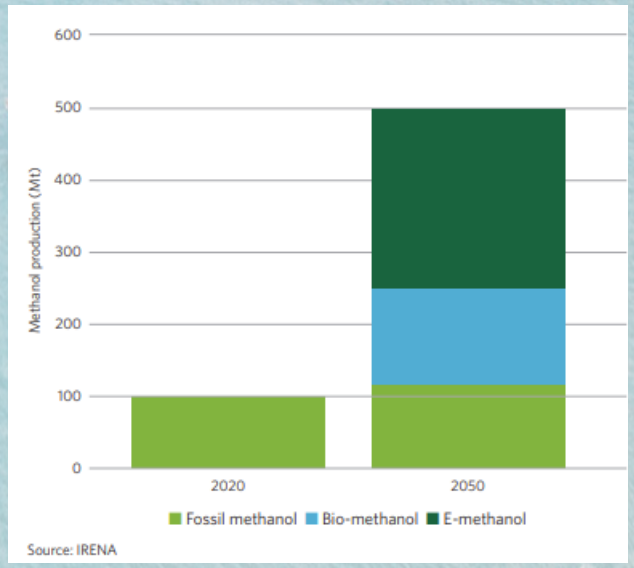


[1]**CIRCULAR METHANOL™** waste to methanol technology combined solution is used under license from NEXTCHEM TECH S.P.A

Decarbonisation of the marine sector could drive a 5-fold increase in methanol demand to 500mtpa in 2050

Methanol as a marine fuel

- ✓ Safety regulations for use as a fuel are already developed
- ✓ Minimal changes to existing bunkering infrastructure required
- ✓ Supported by regulations such as FuelEU and the IMO's GHG reduction strategy
- ✓ Can reduce SOx, NOx and PM compared to HFO
- ✓ Low toxicity towards aquatic life
- ✓ Methanol capable vessels are already in operation and has the fastest growing orderbook of all alternatively fuelled ships*



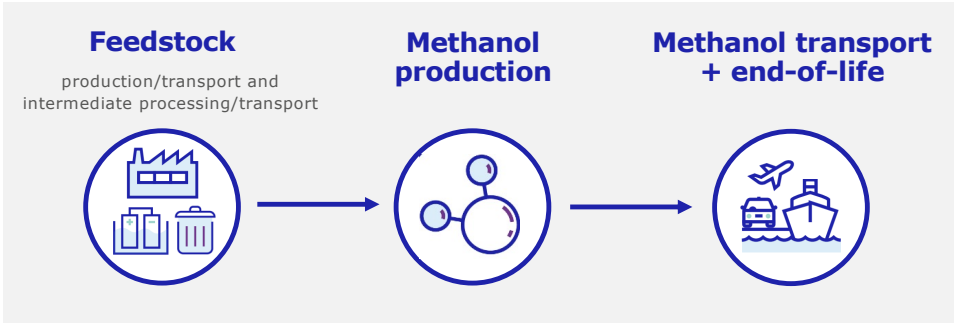
Methanol is an attractive low-carbon intensity marine fuel; As the most developed low carbon option it will play a significant role in the decarbonisation of the maritime industry

*2024 Data - DNV
Innovation Outlook: Renewable Methanol (irena.org)

The carbon intensity of methanol depends on the feedstock and the pathway

Highly efficient processes and low carbon feeds are the key to more sustainable methanol production

How can we make methanol **more sustainably**?



- Use **feedstock** with a **lower carbon intensity** ✓
- **More efficient process** ✓ ✓
- **CO_2 capture**

Prevents the direct **CO_2** emissions from **going to the atmosphere.** Requires **extra energy, utilities, land** and **equipment.**

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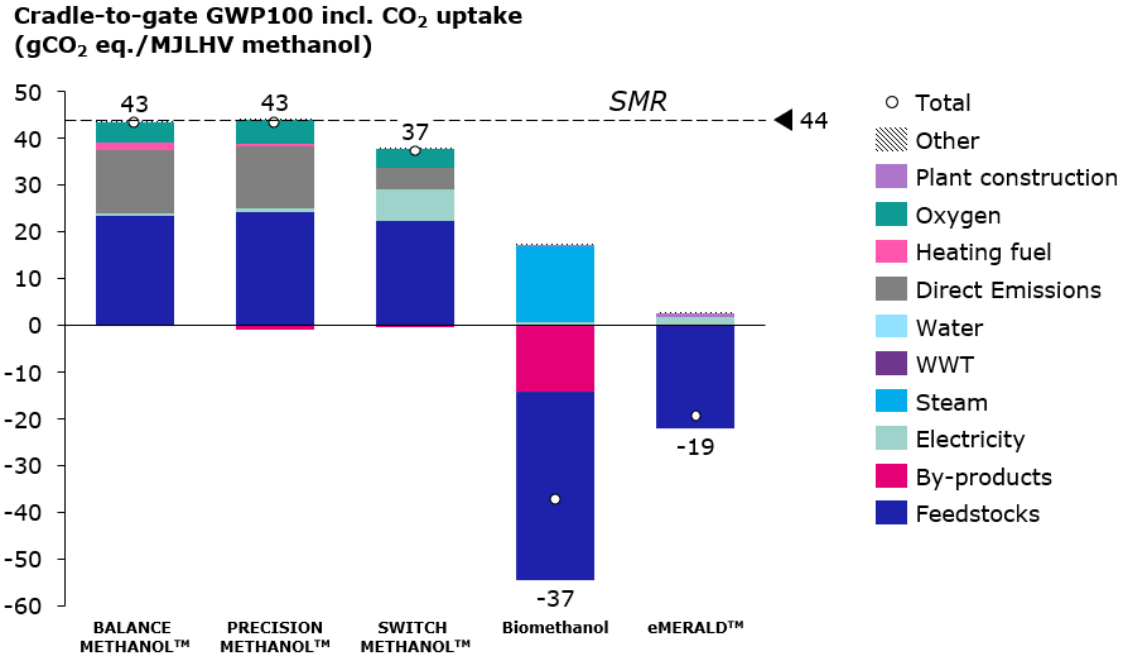
JM's eMERALD™ and biomethanol processes offer credible routes to decarbonisation versus conventional natural gas-based technologies



JM's Biomethanol and eMERALD™ process can offer a 185% and 143% reduction respectively compared to the SMR benchmark

SWITCH Methanol™ can offer 15% reduction in GWP compared to the SMR benchmark, if using 100% renewable electricity this can be increased to a 28% reduction

For more info on the LCA study - Methanol technology LCA | Johnson Matthey

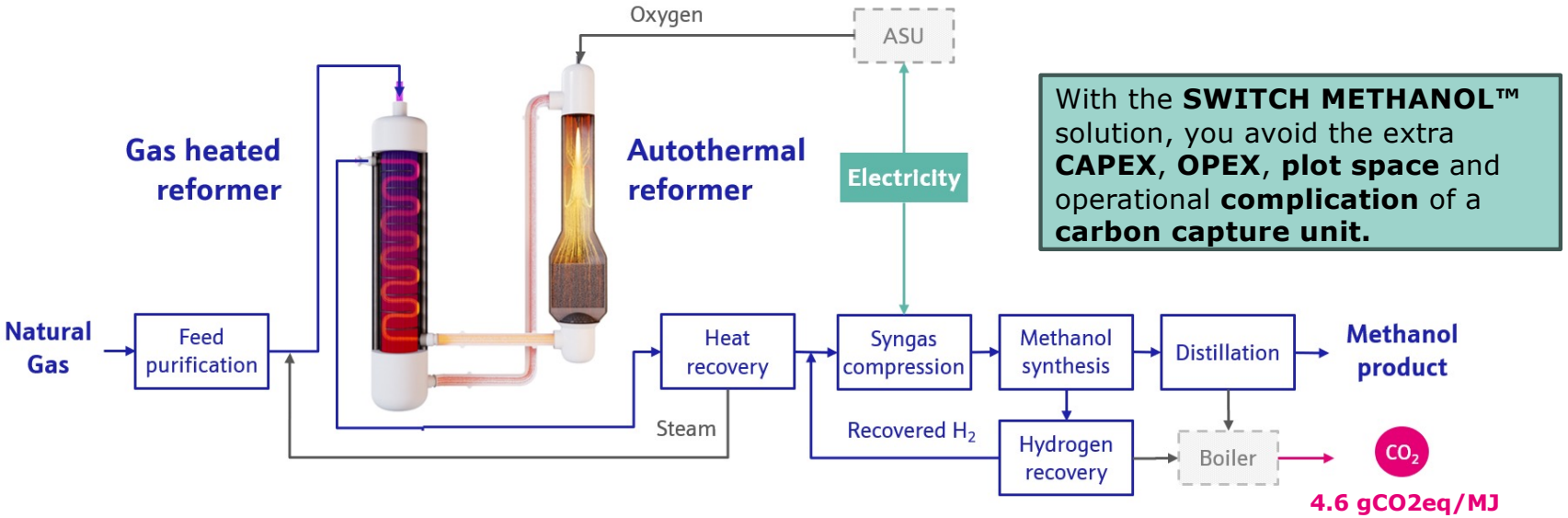
SWITCH METHANOL™ technology

Low emissions without carbon capture
Ready for the energy transition

JM's **SWITCH Methanol™** offers an 86% reduction in direct emissions compared a standard SMR based process

High-efficiency and low direct emissions without carbon capture

Johnson Matthey's **SWITCH METHANOL™** technology



Minimised **natural gas** usage	Minimised direct **CO_2** emissions **without carbon capture**	De-coupled **steam generation** No HP steam raised	Ability to power large machinery with **electricity**	Reduced direct **water consumption**

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SWITCH METHANOL™ vs alterative high efficiency technology

Less natural gas, direct CO_2 emissions and water with the same CAPEX and space

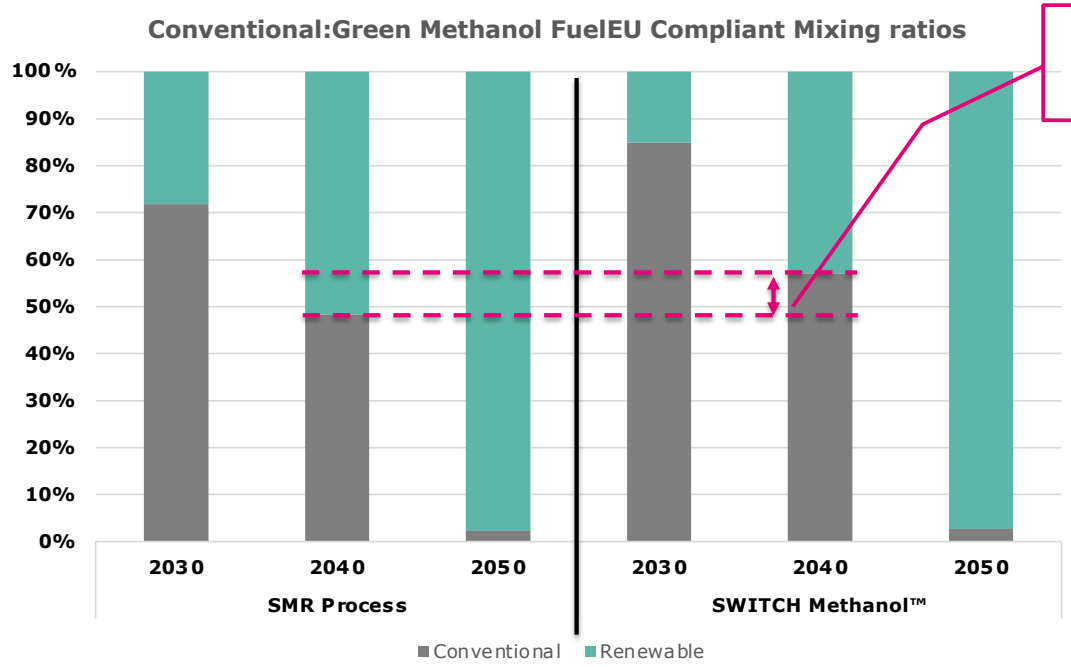
- **14% Less** nat. gas consumption(1)
- **65% Less** direct CO_2 emissions(1,2)
- **Electrified** machinery
- **Smaller** cooling water system(1,3)
- **Less** oxygen import
- **Modular** construction
- **Same** CAPEX
- **Similar** plot area

PRECISION METHANOL™ process + ASU		**SWITCH METHANOL™** process + ASU	
29.5	GJ/te LHV	**25.8**	GJ/te LHV
13.3	g CO_2/MJ LVH	**4.6**	g CO_2/MJ LVH
35	kWh/te	**415**	kWh/te
148	te/te	**55**	te/te
0.66	te/te	**0.48**	te/te
Possible		**Possible**	
Baseline		**Baseline**	

(1) Average overall value for a typical plant. Includes ASU and package boiler consumptions.
(2) Direct process emissions.
(3) Design rate based on a 10°C temperature rise.

SWITCH METHANOL™ enables the highest blending with green methanol

Getting the premium on more natural gas-based methanol increases your profitability



You can **blend more methanol** made via **SWITCH METHANOL™** into your green methanol than any other natural gas-based methanol technology.

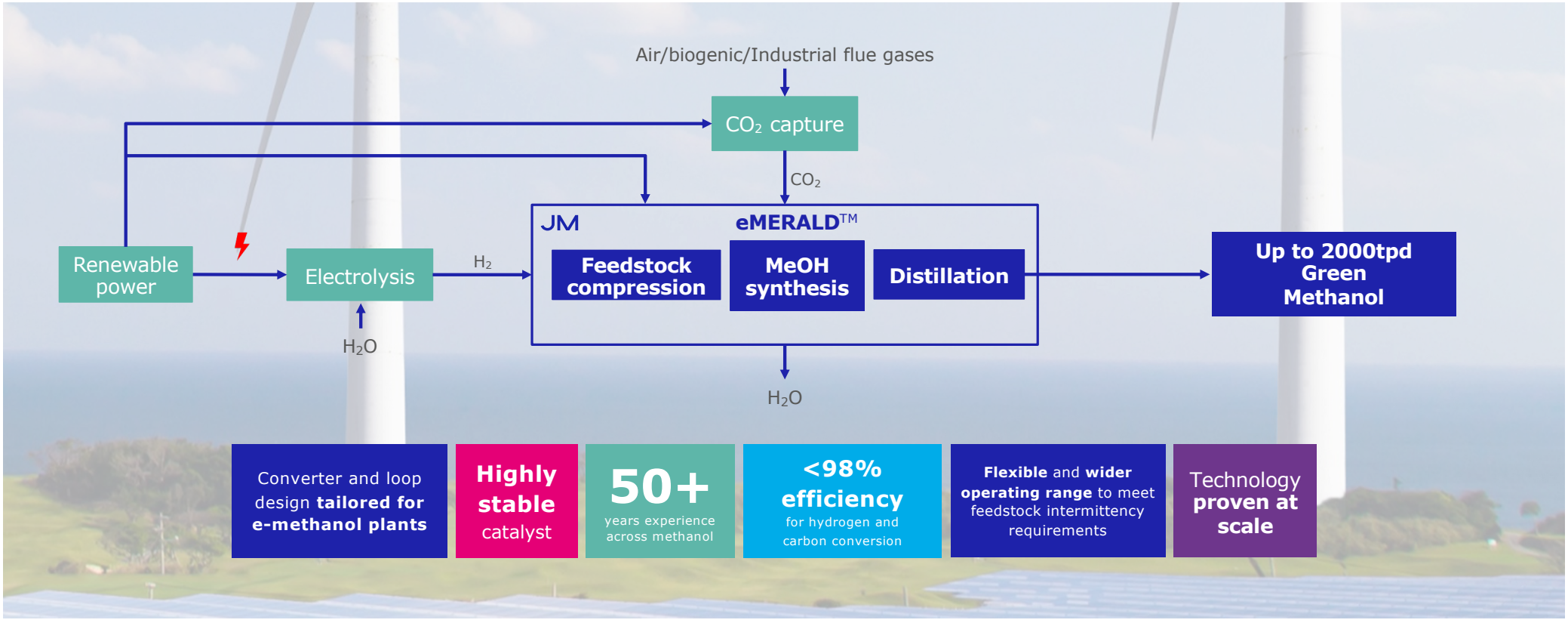
This means **you can use less green methanol** to achieve FuelEU compliance resulting in a **lower-cost fuel blend**

SMR based methanol WtW CI = 113gCO2eq/MJ
SWITCH™ based methanol WtW CI = 98.1gCO2eq/MJ, from JM LCA study – 100% renewable electricity, US natural gas
Green methanol assumed to be biomethanol, WtW = 16gCO2eq/MJ – from JM LCA study – wood chips, WGS, ASU Oxygen, EU renewable energy mix

eMERALD™ CO_2 to methanol technology

Meeting RFNBO mandates

JM **eMERALD™** technology: Pioneering the future of green methanol



JM sustainable methanol technology: breaking ground globally

e-methanol

Haru Oni e-fuels

Magallanes, Chile

eMERALD™

Status

First synthetic fuel produced December 2022

550 million litres of sustainable fuels per year by 2026

HIF eFuels

Uruguay

eMERALD™

Status

PDP

Construction planned for 2025

700,000 tonnes per year of green methanol for shipping and road transport

Bio-methanol

Project Air, Perstorp Group

Stenungsund, Sweden

Methanol synthesis from CO_2, biogas and H_2

Status

PDP finished

Expected to be fully operational by 2026

200,000 tonnes of sustainable MeOH per year to substitute fossil MeOH used by Perstorp in Europe

MSW to MeOH Confidential client

Europe

[1]CIRCULAR METHANOL™

Status

PDP

~100ktpa renewable methanol as maritime fuel

ABEL Energy

Bell Bay project, Tasmania

Biomass to methanol

Status

BEP in 2024

2027 start up

300,000 tonnes per year of green methanol; equivalent to removing 540,000 tonnes of CO_2 from the atmosphere

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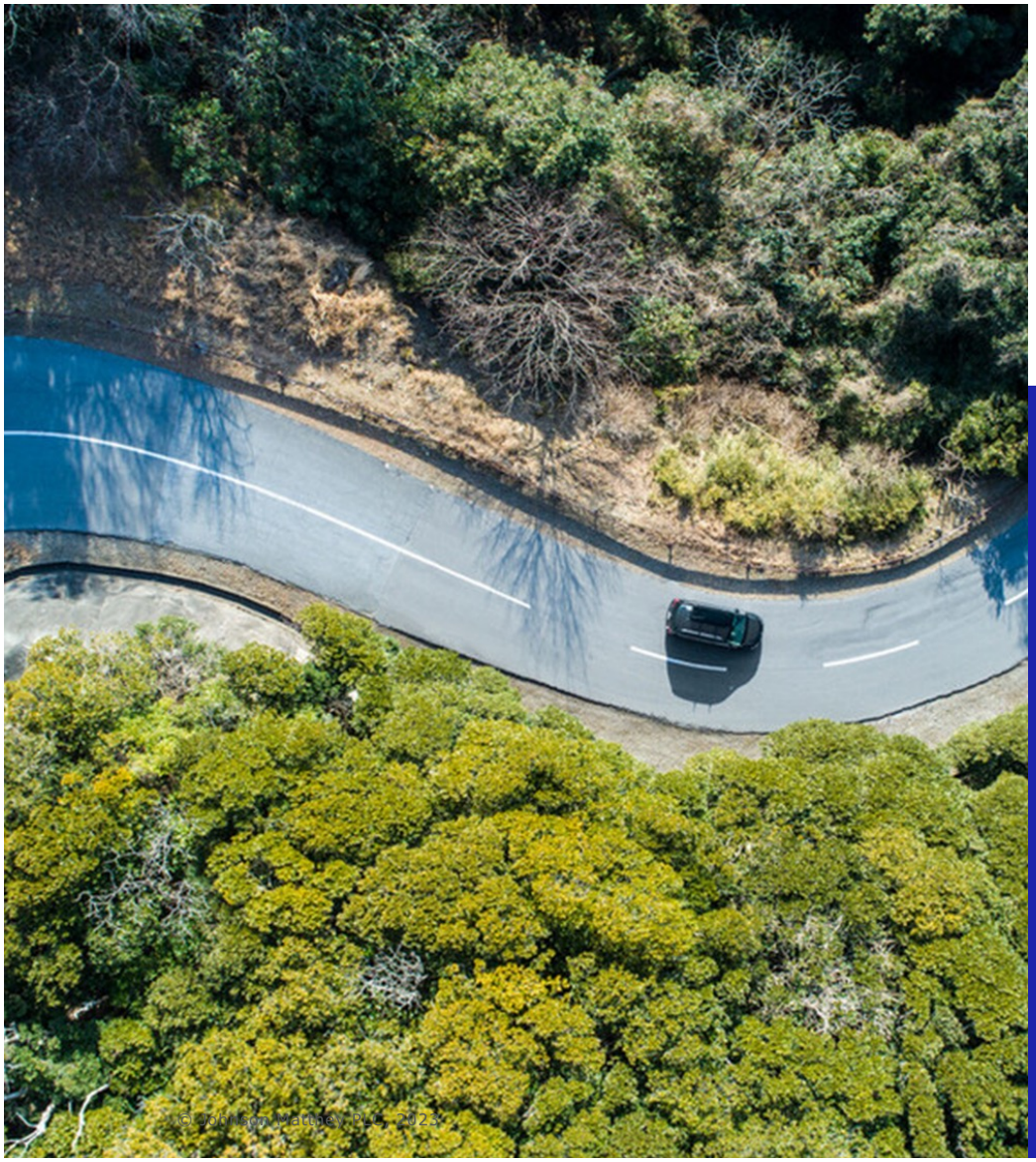
JM's recently announced low-carbon hydrogen and sustainable fuel projects

[1] SAF: Sustainable Aviation Fuel
[2] LCH : JM's Low carbon hydrogen technology
[3] CCM: Catalyst Coated Membrane
[4] WtM: Waste to methanol



Catalysing the net zero transition for our customers, and for society

A call for action.

What steps are you taking to accelerate steel-in-the-ground solutions to decarbonize our industry.

Let's talk

cameron.hibbert@jmusa.com