



# JM

Johnson Matthey  
Inspiring science, enhancing life

 **NextChem**  
Maire Tecnimont for Energy Transition

 **MyRechemical**

## Waste to Methanol MyRechemical and Johnson Matthey

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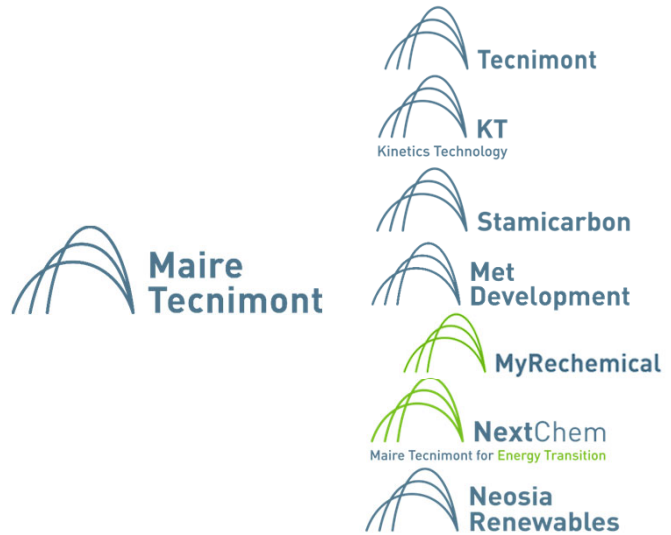


# Introductions



# MAIRE TECNIMONT GROUP

## OPERATING COMPANIES



HYDROCARBONS

GREEN ENERGY

## PRESENCE IN THE WORLD

**~9,300**

EMPLOYEES & PROFESSIONALS

**50**

OPERATING COMPANIES

**45**

COUNTRIES

## FY 2019 & 2020 RESULTS



REVENUES

2019 **€3.4** BLN

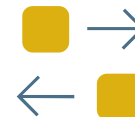
2020 **€2.6** BLN



EBITDA

2019 **€236** MLN

2020 **€172** MLN



BACKLOG

2019 **€6.4** BLN

2020 **€6.0** BLN

## JM GLOBAL METHANOL EXPERIENCE

JM's technology and catalysts provides the world's premier process for production of methanol from syngas

- JM have for > 60 years supplied the methanol industry with leading technology and catalysts.
- Over 50% of all global methanol capacity is JM technology
- Licensed into over 100 plants in 35 countries.
- Large number of coal based methanol plants operating or being built in P.R. China use JM technology





## Waste to methanol market

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# WASTE HIERARCHY – WASTE FRAMEWORK DIRECTIVE

## OUR TARGET

Refuse-derived fuel

MRF residues

Unrecyclable plastics

Sanitary waste

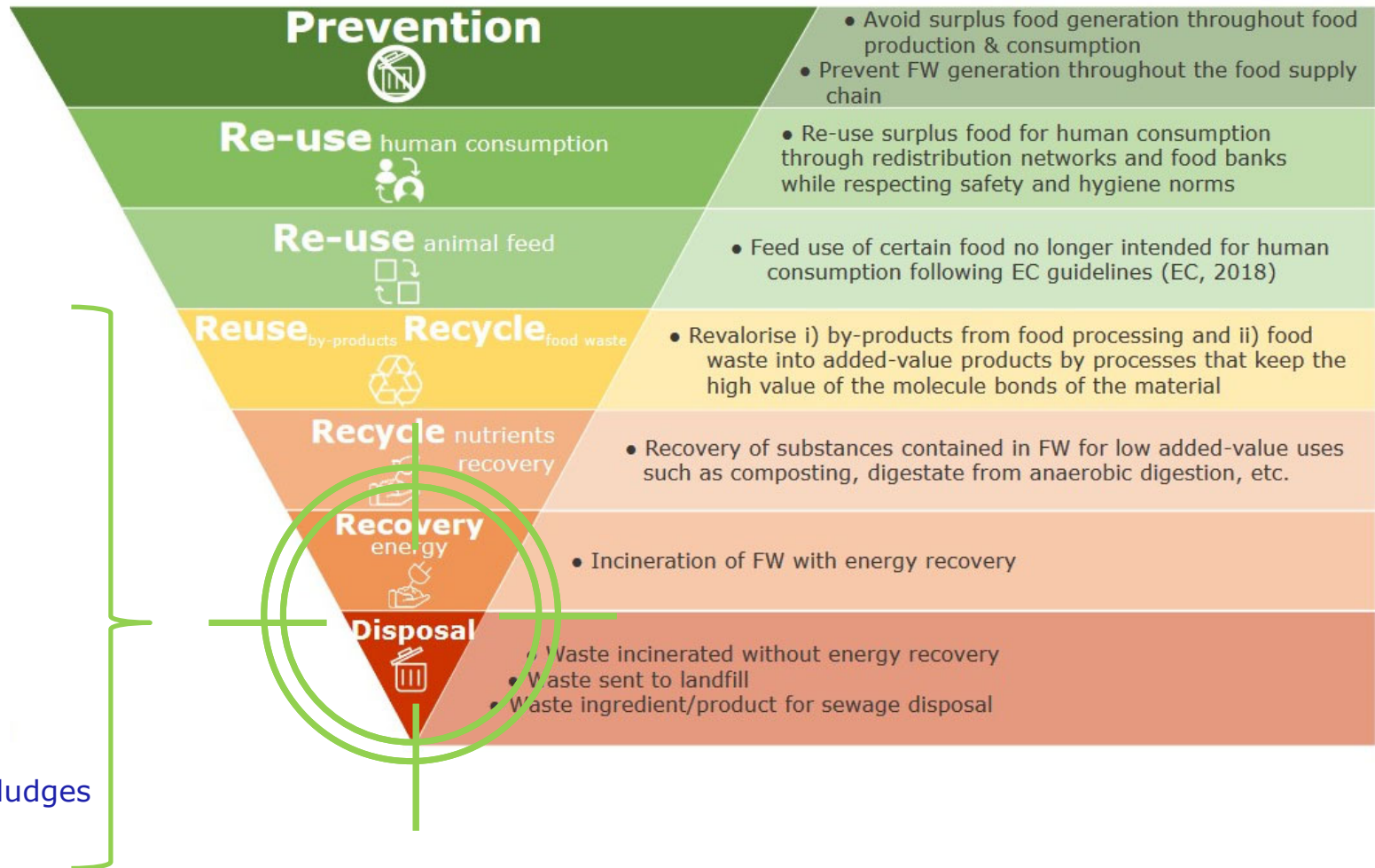
Forest residues

Car fluff

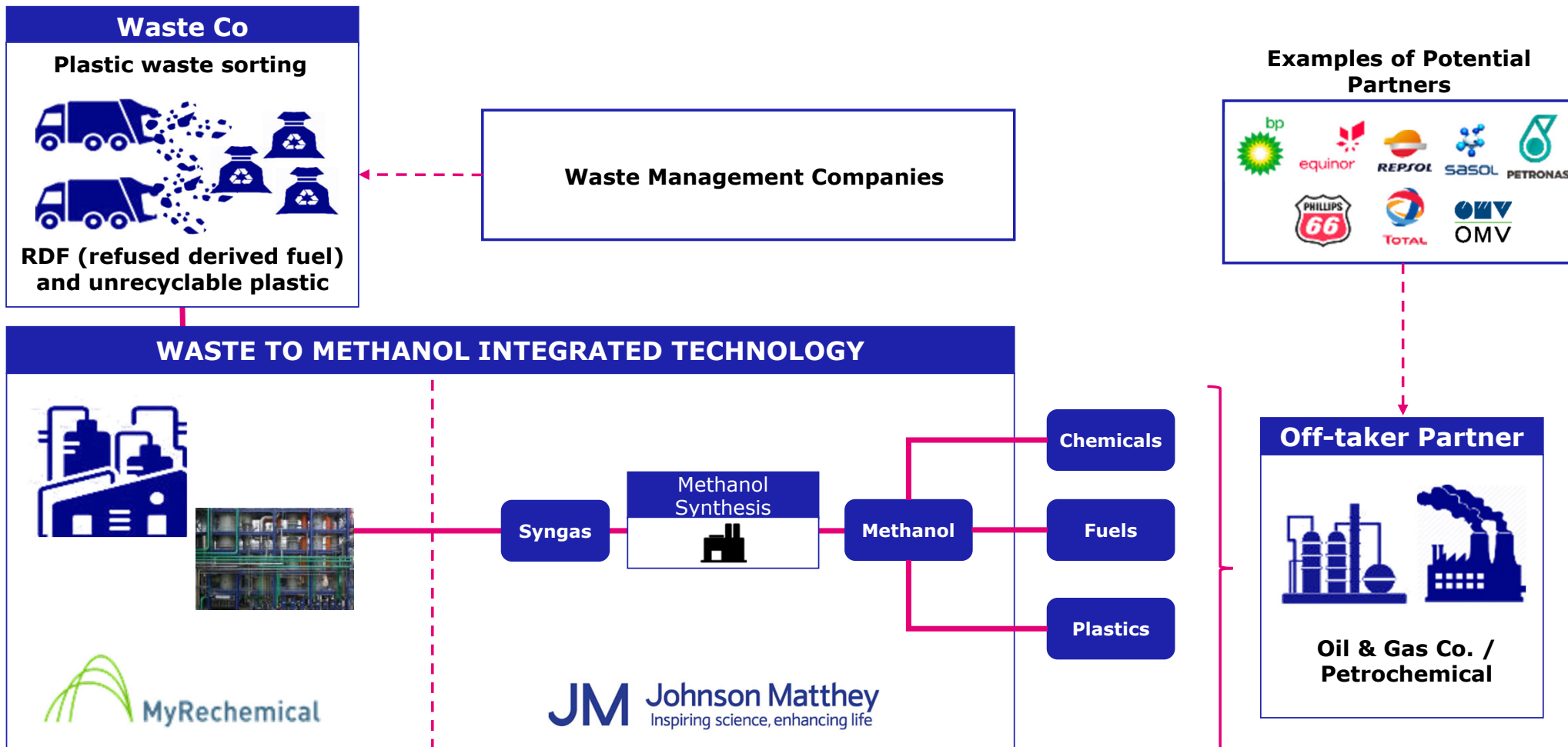
Solid industrial waste

Industrial / municipal sludges

Others



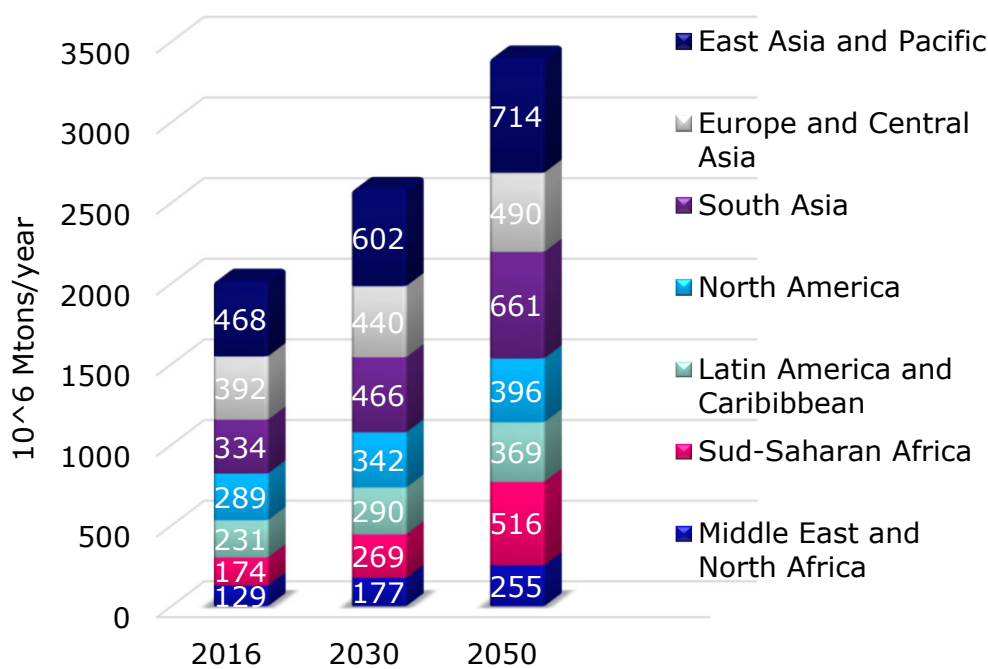
# WASTE CONVERSION TO CHEMICALS AND ROLES OF PARTIES





# WORLD MUNICIPAL SOLID WASTE PRODUCTION 2016-2050

World production of waste is close to 2 Billion Mtons per year.  
 Due to growth of population and GDP, it is expected to reach 3,4 Billion Mton per year in 2050 (WorldBank).



0.74 kg per day per capita  
 (but ranges widely, from 0.11 to 4.54)



REFUSE DERIVED FUEL

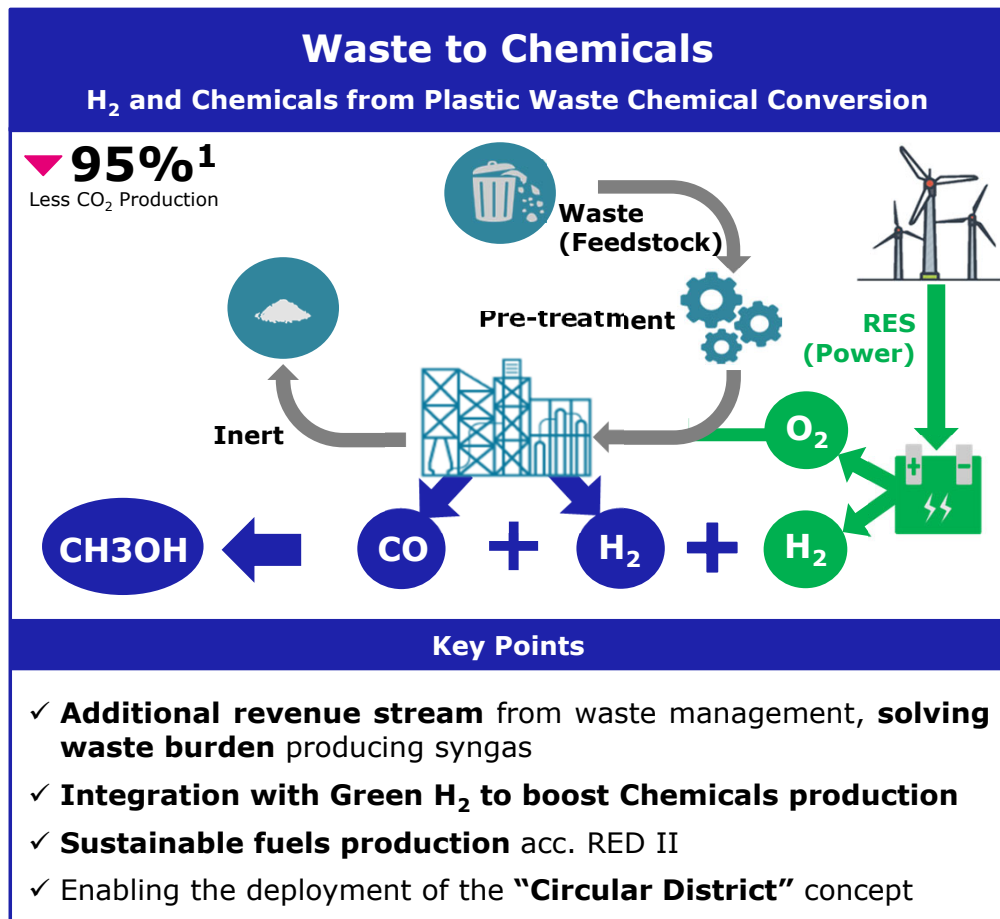
<b>C</b>	32-55% w
<b>H</b>	5-8% w
<b>O</b>	20-28% w
<b>Cl</b>	0.5-3% w
<b>N</b>	0.5-1.5% w
<b>S</b>	0.1-1% w
<b>Moisture</b>	10-20% w
<b>Ashes</b>	5-20% w



Non RECYCLABLE PLASTIC

<b>C</b>	47-61%
<b>H</b>	5-7%
<b>O</b>	14-20%
<b>Cl</b>	0.8-1.5%
<b>N</b>	0.2-0.5%
<b>S</b>	0.02-0.3%
<b>Moisture</b>	5-9%
<b>Ashes</b>	7-20%

# WASTE TO CHEMICALS: VALORIZING WASTE INTO FUELS AND CHEMICALS



Note: (1) vs. conventional Methanol synthesis, > 100% achievable with 100% renewable energy and/or with integrated electrolysis



## NextChem and the **"Waste to Chemicals"**: the solution coming from the problem

NextChem is bringing to the market a Chemical Conversion technology based on Waste Gasification. Exploiting this technology, low-carbon Circular Hydrogen and low-carbon Chemicals can be produced.



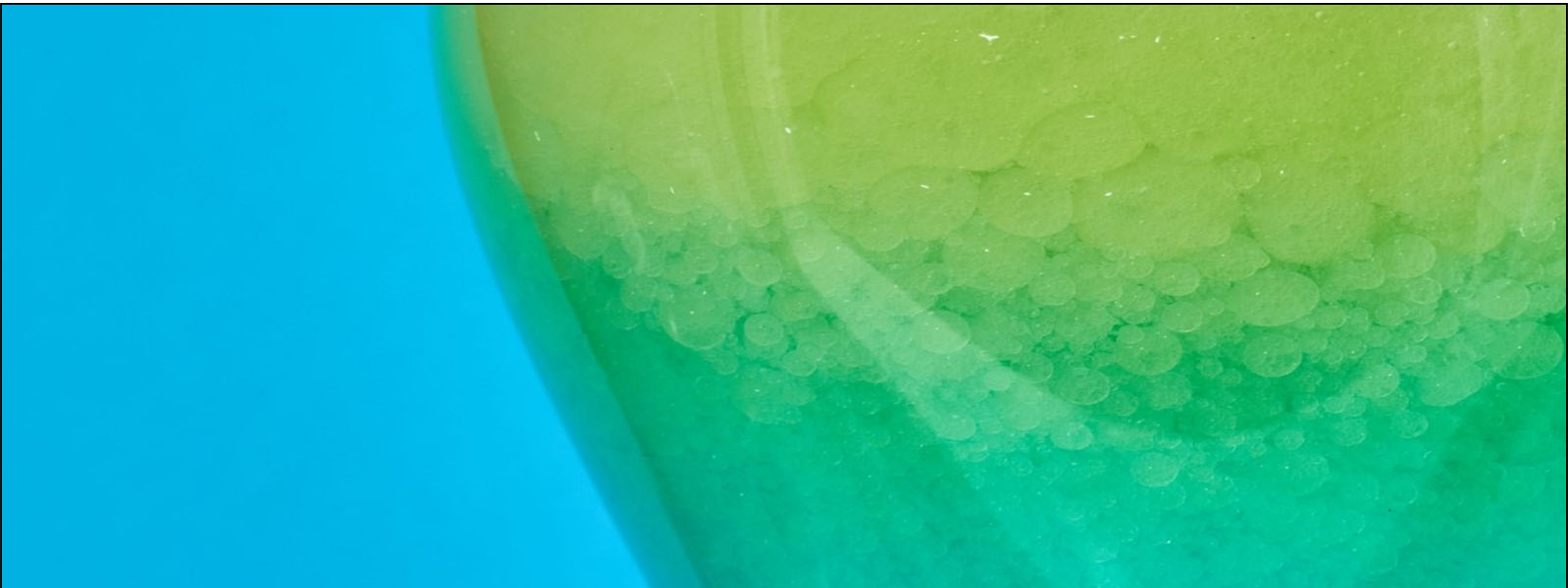
- ✓ proven and referenced technology
- ✓ non-recyclable waste as a feedstock
- ✓ integration with **Green H<sub>2</sub>** for Circular Chemicals

**190** KTA OF FEEDSTOCK WASTE → **100** KTA OF METHANOL

READY FOR MARKET IN  
**TODAY**

**190** KTA OF FEEDSTOCK WASTE → **200** KTA OF METHANOL  
**120** GREEN H<sub>2</sub> MW



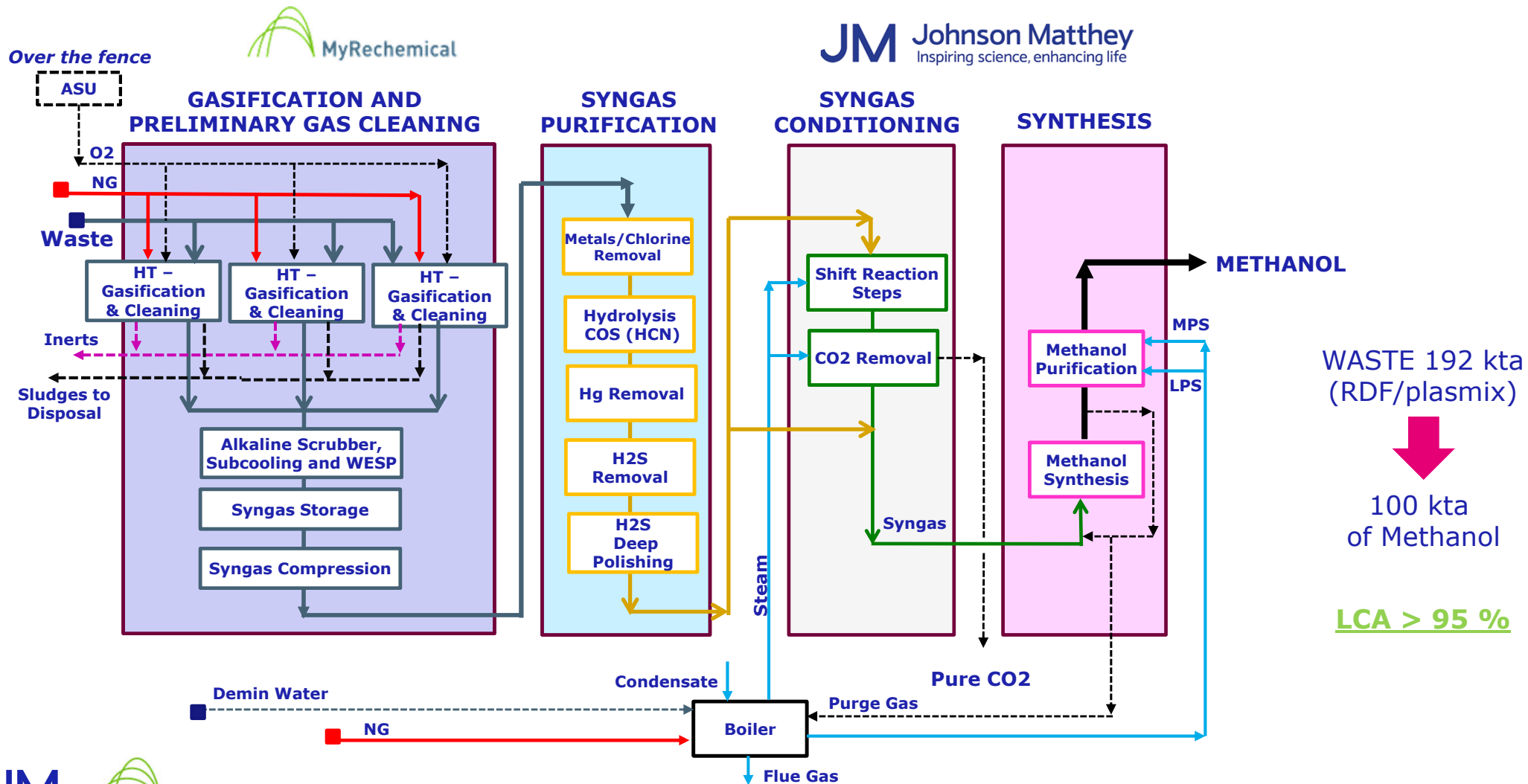


## Waste to methanol technology

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# WASTE TO METHANOL SIMPLIFIED SCHEME



WASTE 192 kta  
(RDF/plasmix)







100 kta  
of Methanol

LCA > 95 %

# ROBUST, PROVEN GASIFICATION TECHNOLOGY



JFE Engineering Corporation

	CHIBA	MUTSU	OSAKA	TOKUSHIMA	ISAHAYA	KURASHIKI
CAPACITY	80 kta	45 kta	28 kta	36 kta	90 kta	150 kta
LINES	2	2	2	2	3	3
STATUS	20 YEARS OF OPERATION					
FEED	 INDUSTRIAL WASTE AND SLUDGE	 INDUSTRIAL WASTE	 MUNICIPAL AND INDUSTRIAL SOLID WASTE	 MUNICIPAL SOLID WASTE	 MUNICIPAL SOLID WASTE	 INDUSTRIAL SOLID WASTE

JFE Engineering Corporation and MyRechemical signed CCA to cooperate on Waste to Chemical projects.

- JFE plants are available at MyRechemical clients for:
- Visits as reference plants
- Training of engineers and operators

JFE Engineering Corporation support MyRechemical for:

- Engineering support
- Precommissioning, Commissioning, Start-up
- Troubleshooting




MORE THAN **40** REFERENCES INCLUDING BOTH **ENRICHED AIR** AND **PURE O<sub>2</sub>** AS GASIFICATION AGENT

ON THE LEFT ARE LISTED THOSE PLANTS THAT WORK WITH PURE O<sub>2</sub> AS A GASIFICATION AGENT.



## SYNGAS PURIFICATION AND CONDITIONING

- Proven purification catalyst and absorbents to remove chlorides, hydrogen cyanide, mercury and hydrogen sulphides
- Shift converts  $\text{CO} + \text{H}_2\text{O}$  to  $\text{H}_2 + \text{CO}_2$
- Acid Gas Removal (AGR) removes excess  $\text{CO}_2$

TYPICAL SYNGAS COMPOSITION			
Syngas technology	R ratio	CO/CO <sub>2</sub>	% CH <sub>4</sub>
Steam methane reformer	2.9	2	3
Waste gasification	1.9 <sup>1</sup>	4	0.2

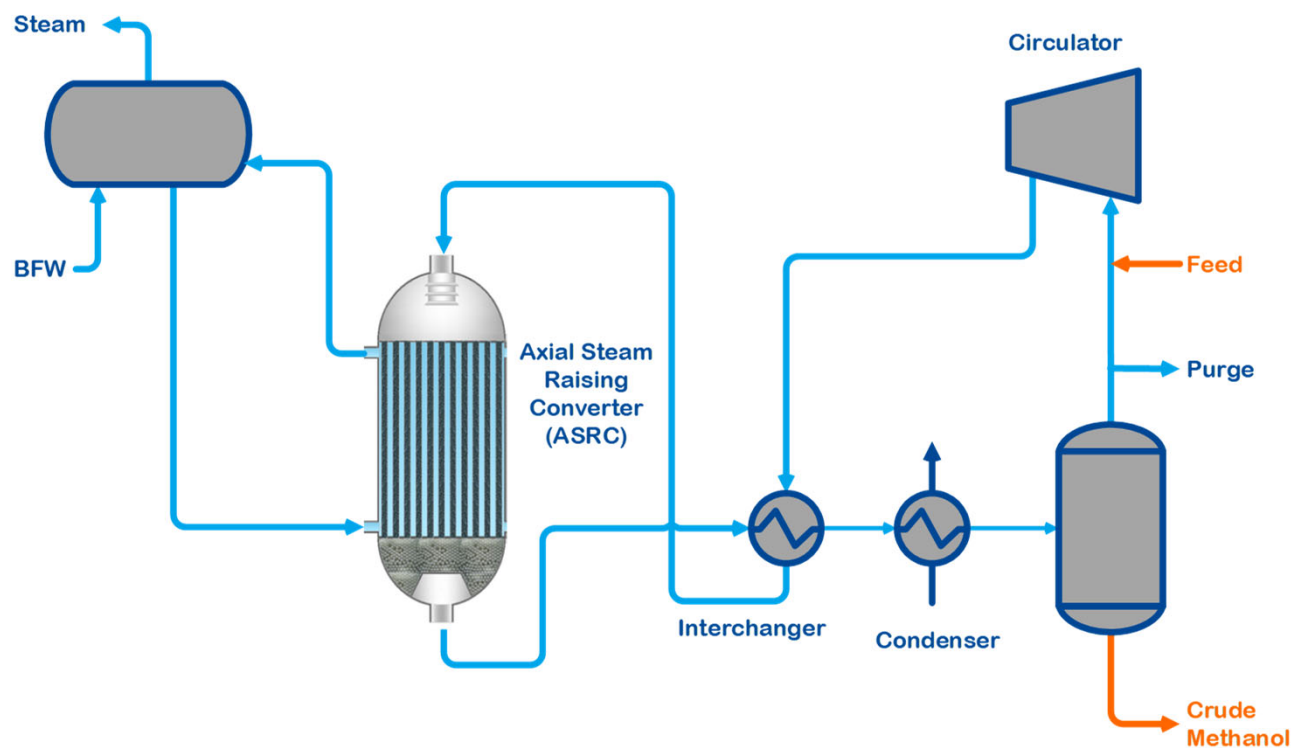
- R ratio – Excess H<sub>2</sub>       $R = ([\text{H}_2] - [\text{CO}_2]) / ([\text{CO}] + [\text{CO}_2])$
- CO/CO<sub>2</sub> – Heat of reaction / reactivity
- CH<sub>4</sub> – Loop efficiency

<sup>1</sup>R ratio is before addition of hydrogen recycle from loop purge gas



# METHANOL SYNTHESIS

- Single Axial Steam Raising Converter (ASRC) Loop
- Extensive experience with similar syngas composition
- Utilises high activity JM catalyst
- Optimised circulation ratio



## JM DISTILLATION

### Chemical grade

- US Federal AA grade / IMPCA
- Topping column to remove lights
- One or two columns to remove water/ heavies

### Fuel grade

- Single column





Recent example

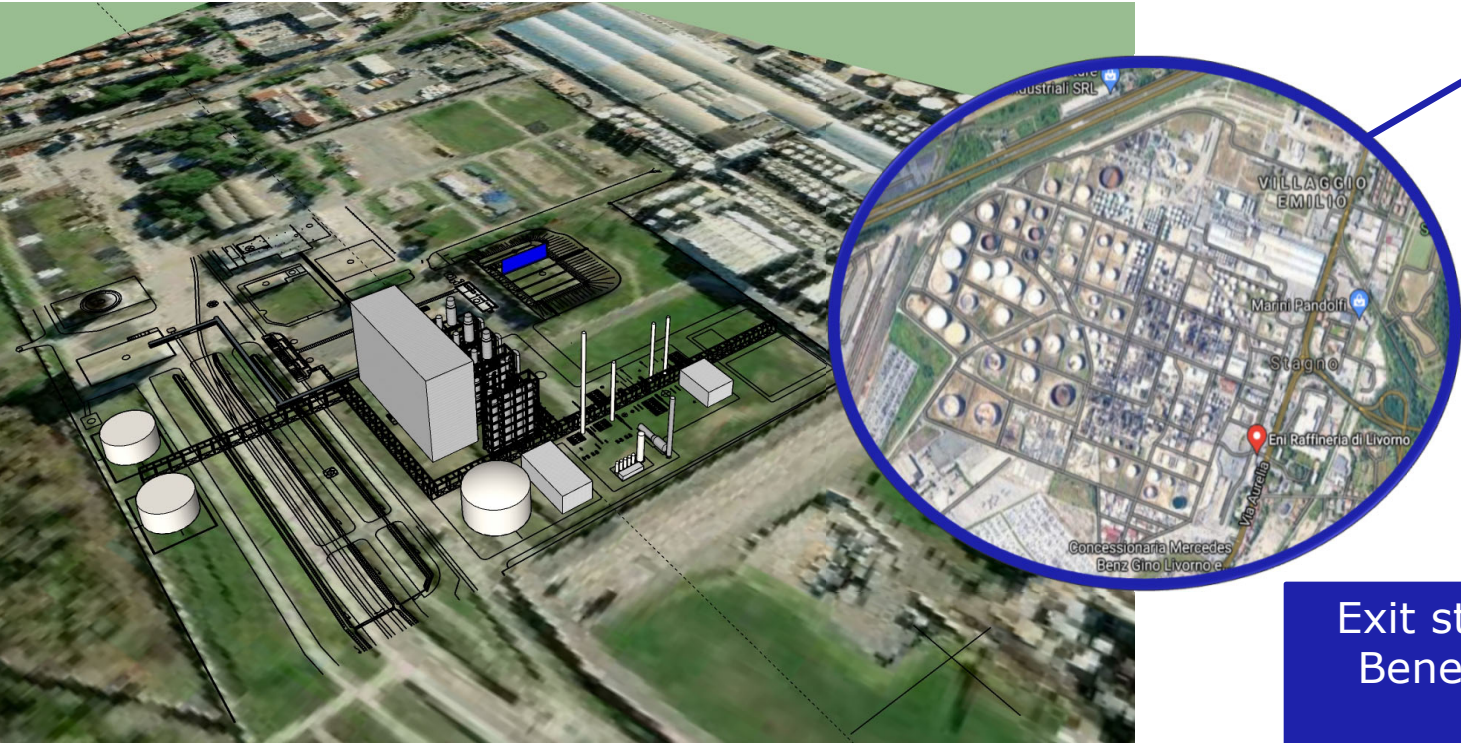
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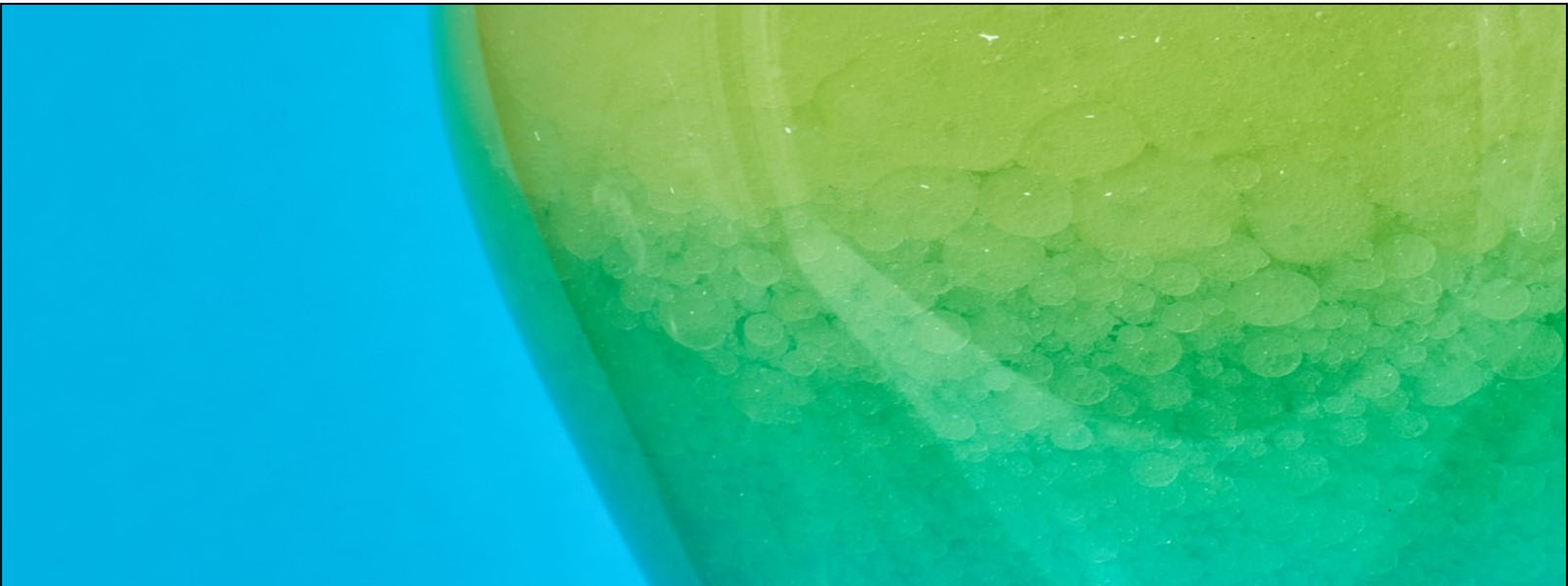
# WASTE TO METHANOL IN BROWN FIELDS

Typical plot area for 200 kta Waste to Methanol is 150 meters x 200 meters.

*(in the picture rendering of Waste to Methanol in ENI Livorno Refinery - IT)*



Exit strategy for brown fields.  
Benefits by integrating with existing facilities.

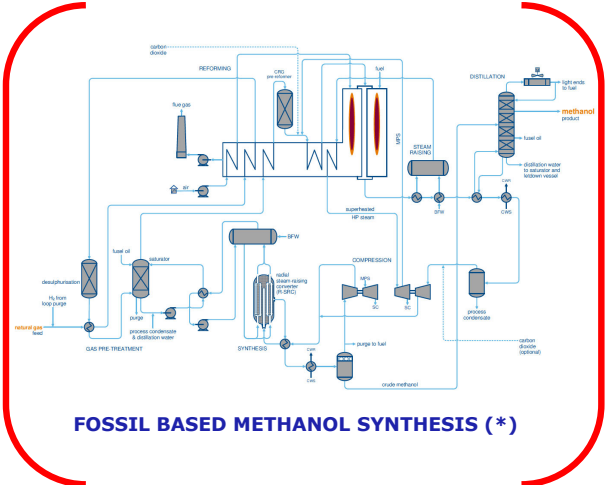


Analysis and conclusions

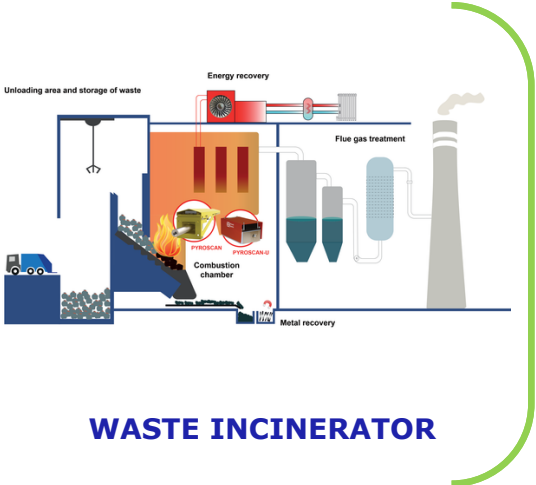
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# LCA ANALYSIS AND CO2 SAVING

$$\text{SAVING CO}_2 = \frac{[\text{CO}_2 \text{ conventional process}] - [\text{CO}_2 \text{ Waste to Chemicals} - \text{CO}_2 \text{ incineration}]}{[\text{CO}_2 \text{ conventional process}]}$$



VS



Electric grid  
30% renewable

**Saving CO<sub>2</sub> = 95%**  
**CO<sub>2</sub> avoided = 215,000 t/a**

Electric grid  
100% renewable

**Saving CO<sub>2</sub> = 131%**  
**CO<sub>2</sub> avoided = 295,000 t/a**



(\*) SPECIFIC EMISSION 2.7 TON CO<sub>2</sub>/TON METHANOL

## CONCLUSION

- Proven gasification and methanol technology combined to provide a single waste to methanol licensed offering
- Flowsheet developed to achieve a sustainable solution on the road to net zero
  - Utilises waste
    - To produce useful chemical product and reduce CO<sub>2</sub> emissions
    - Reduce landfill
  - Capacity to utilise green hydrogen to achieve additional CO<sub>2</sub> emissions reduction



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# Johnson Matthey ProcessWise Webinars Waste to methanol



## Questions and Answers

Please submit your questions, feedback and suggestions for future webinar topics through the Team Live Events Q&A panel on the right of your screen

