



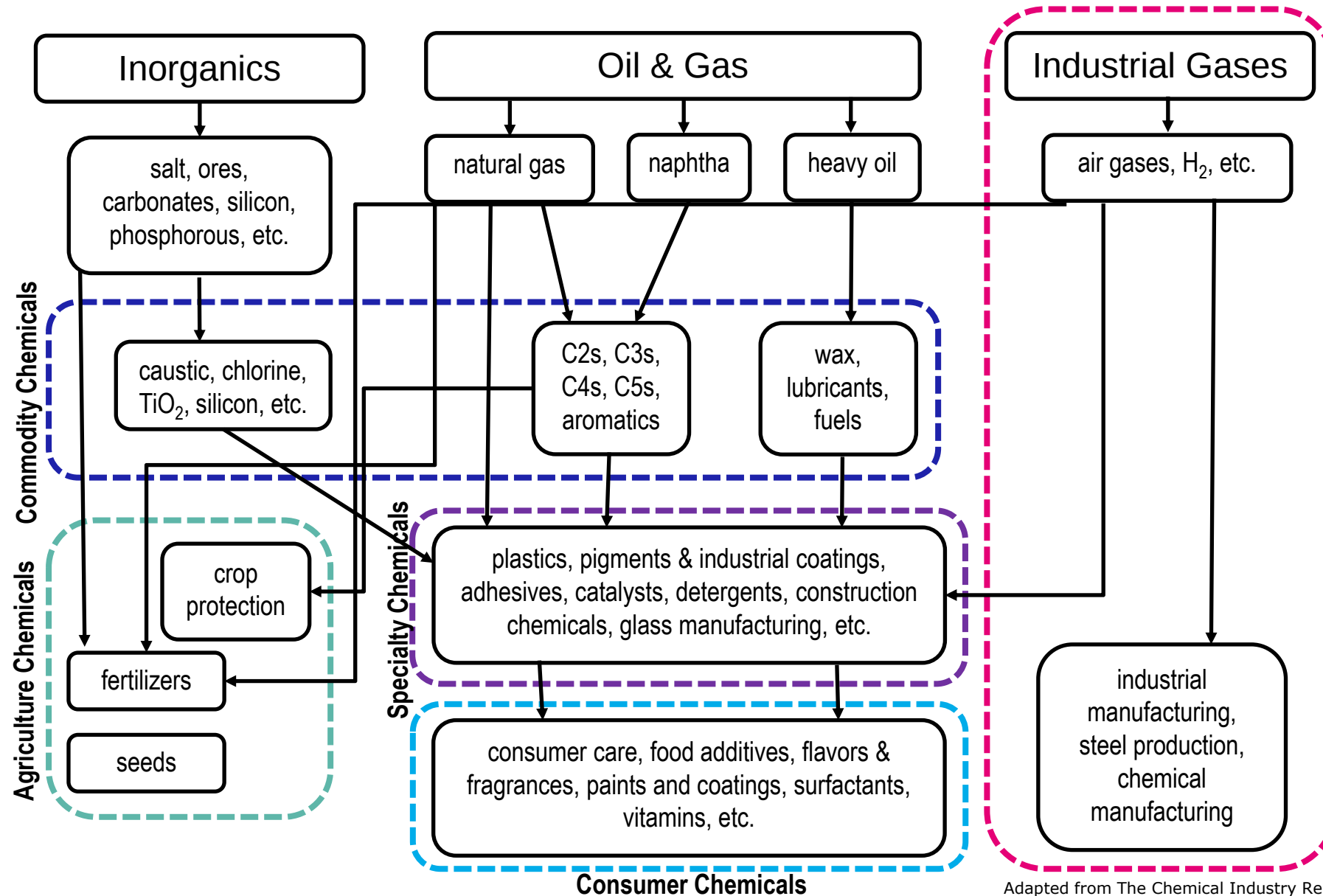
Johnson Matthey  
Inspiring science, enhancing life

# Opportunities for CO<sub>2</sub> Utilization

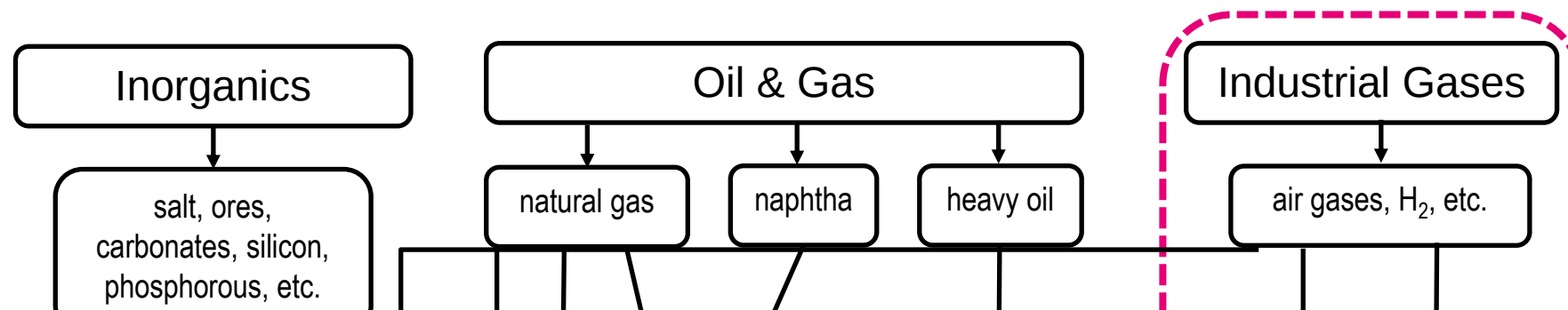
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Cathy Tway, Technology and Applications Director, Catalyst Technologies  
Johnson Matthey

# Integration and scale – added complexity & opportunity

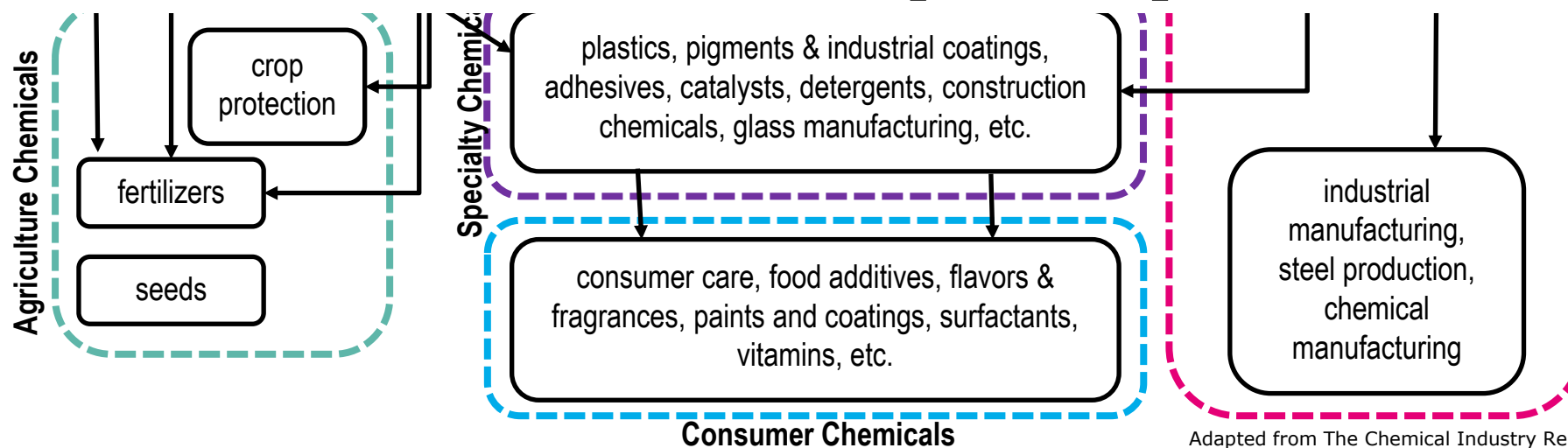


## Integration and scale – added complexity & opportunity

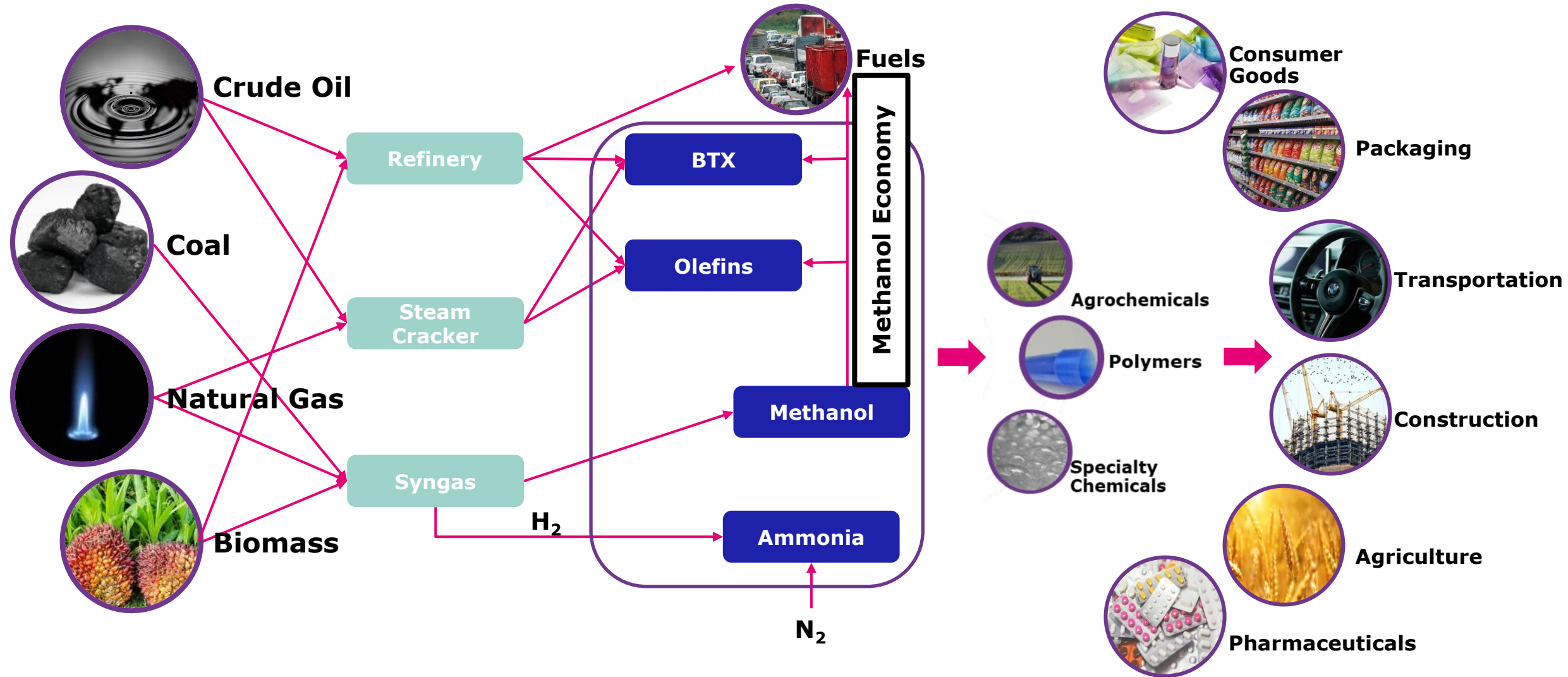


**“The biggest obstacle to innovation is a paid off plant.”**

**–From the Innovation Abyss by Chris DeArmitt**



# Today...optimized around the current feedstocks



# JM global methanol experience

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

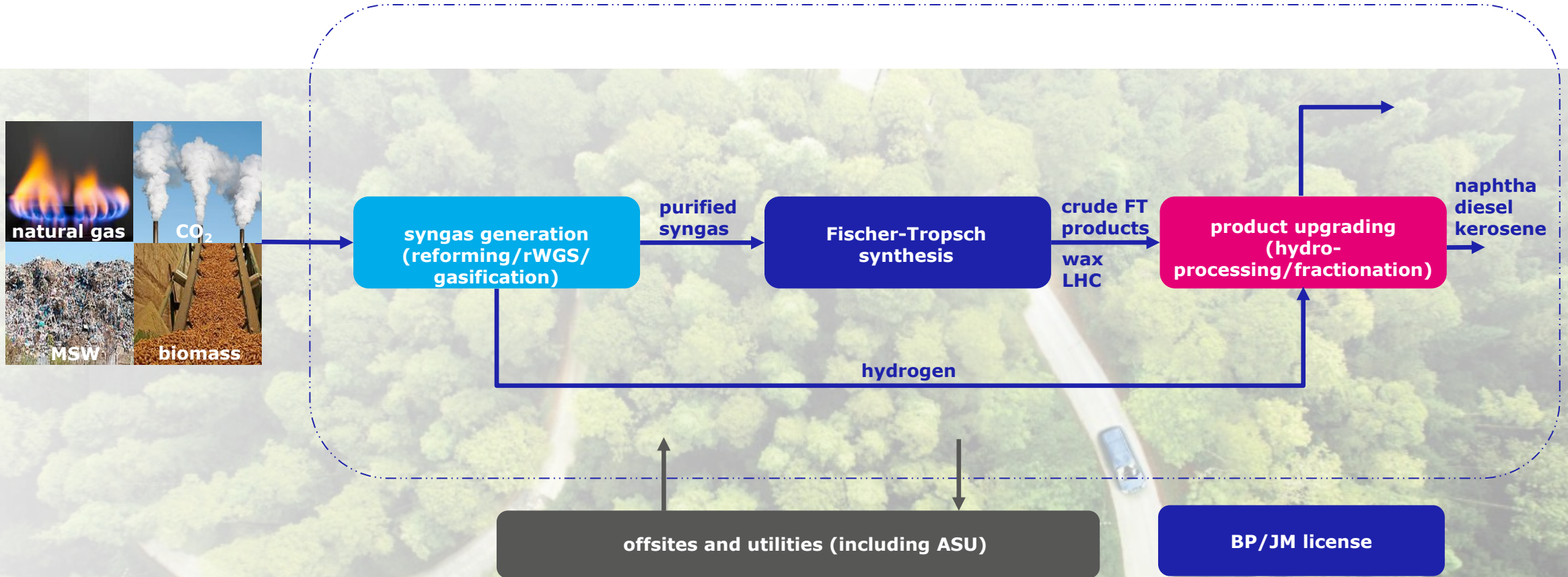
- JM have for > 60 years supplied the methanol industry with leading technology and catalysts.
- Licensed into over 100 plants in 35 countries.
- 60 million tonnes per annum of licensed methanol capacity.
- Same technology applied to conventional syngas and CO<sub>2</sub> + green hydrogen



# Haru Oni e-fuels project - Chile

- JM technology selected for **world's first climate neutral methanol plant**
- Demonstrate technology for world's first large-scale commercial plant producing climate neutral **e-methanol and e-gasoline from green hydrogen and CO2 recovered by direct air capture**
- **900,000 litres** of e-methanol produced per year as early as 2022, growing to 55 million litres of e-fuels by 2024 and c.**550 million litres by 2026**

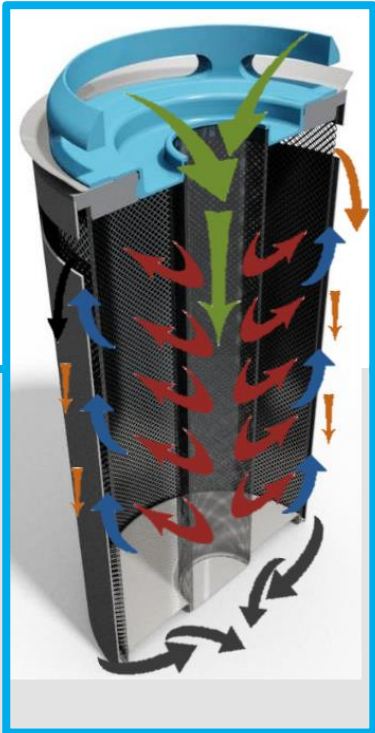
# FT SAF - Diesel Flowsheet



- For natural gas / CO<sub>2</sub> feedstocks JM also provides the syngas generation technology and catalysts
- For MSW, biomass and coal feedstocks, JM can provide the secondary gas clean-up

# JM's FT CANS™: waste to aviation fuel

In partnership with 



Novel reactor and catalyst design



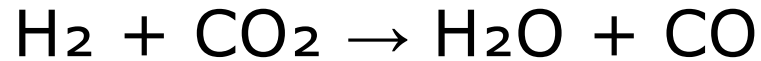
Renewable transportation fuel from municipal solid waste

**180 sustainable flights  
between London and  
New York per year**



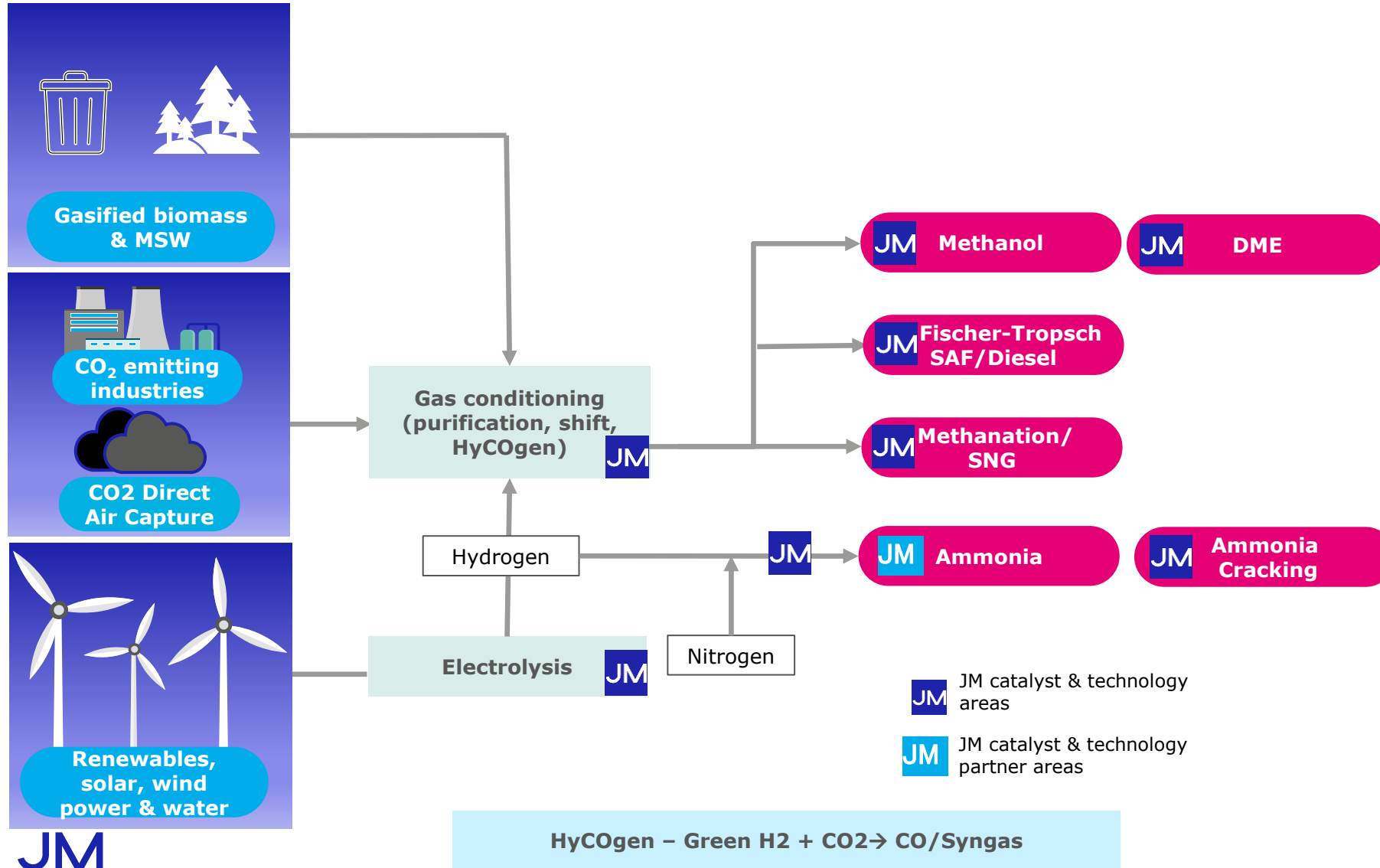
# JM's Reverse Water Gas Shift technology (**HyCOgen™**)

- JM is a world-leader in syngas generation technologies and syngas applications
- Water Gas Shift reaction technology well known and practiced by JM
- Reverse Water Gas Shift (RWGS) reaction is an endothermic reaction requiring high temperatures to drive conversion



- JM has extensive expertise and experience in addressing the challenges associated with the rWGS technology, including:
  - High temperature operation
  - Heat integration
  - Complex metallurgy
  - Optimum use of different catalysts
- JM has developed the **HyCOgen™** technology, optimised for integration with FT synthesis

# JM is enabling sustainable and efficient waste, biomass and power-to-x transformations by leveraging its core expertise in the syngas value chain

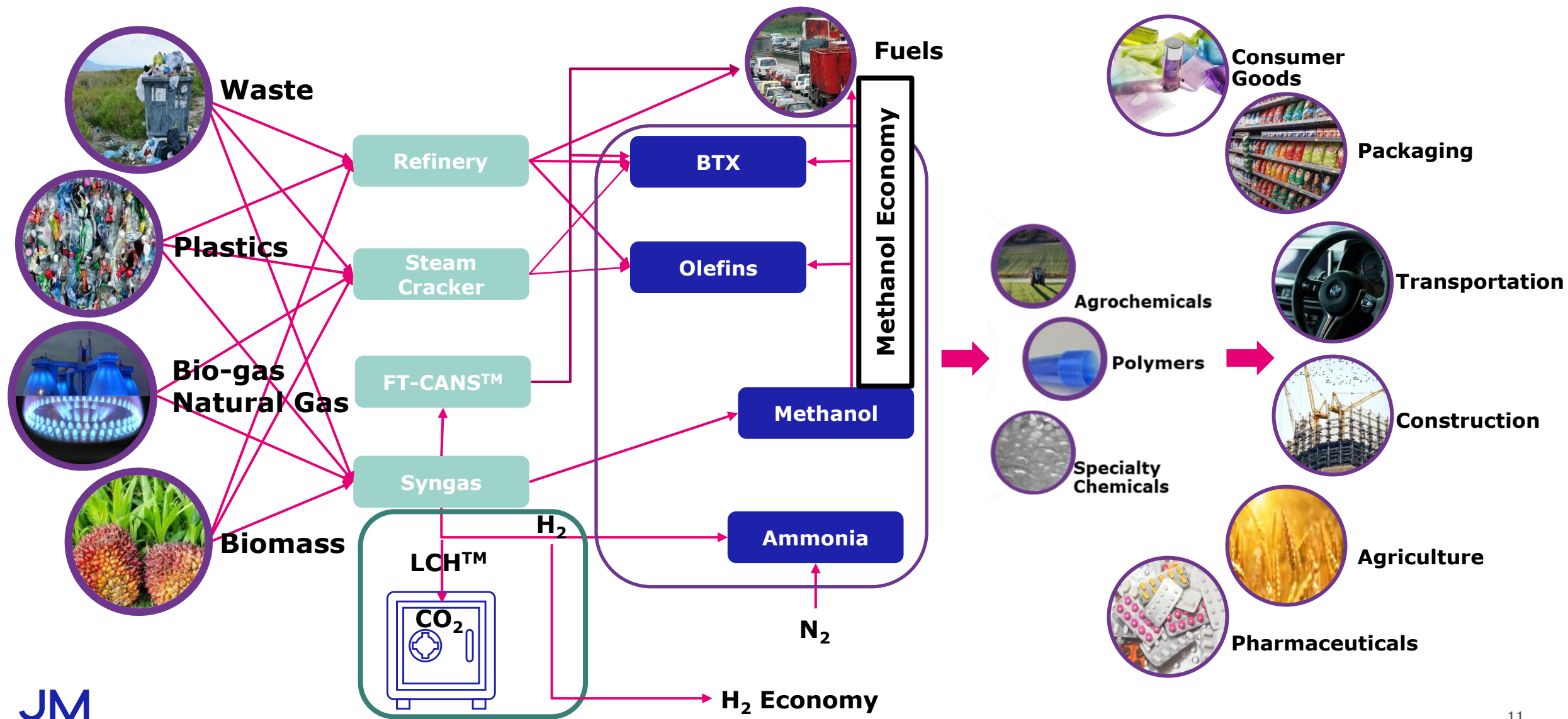


## JM is a leader in syngas technologies

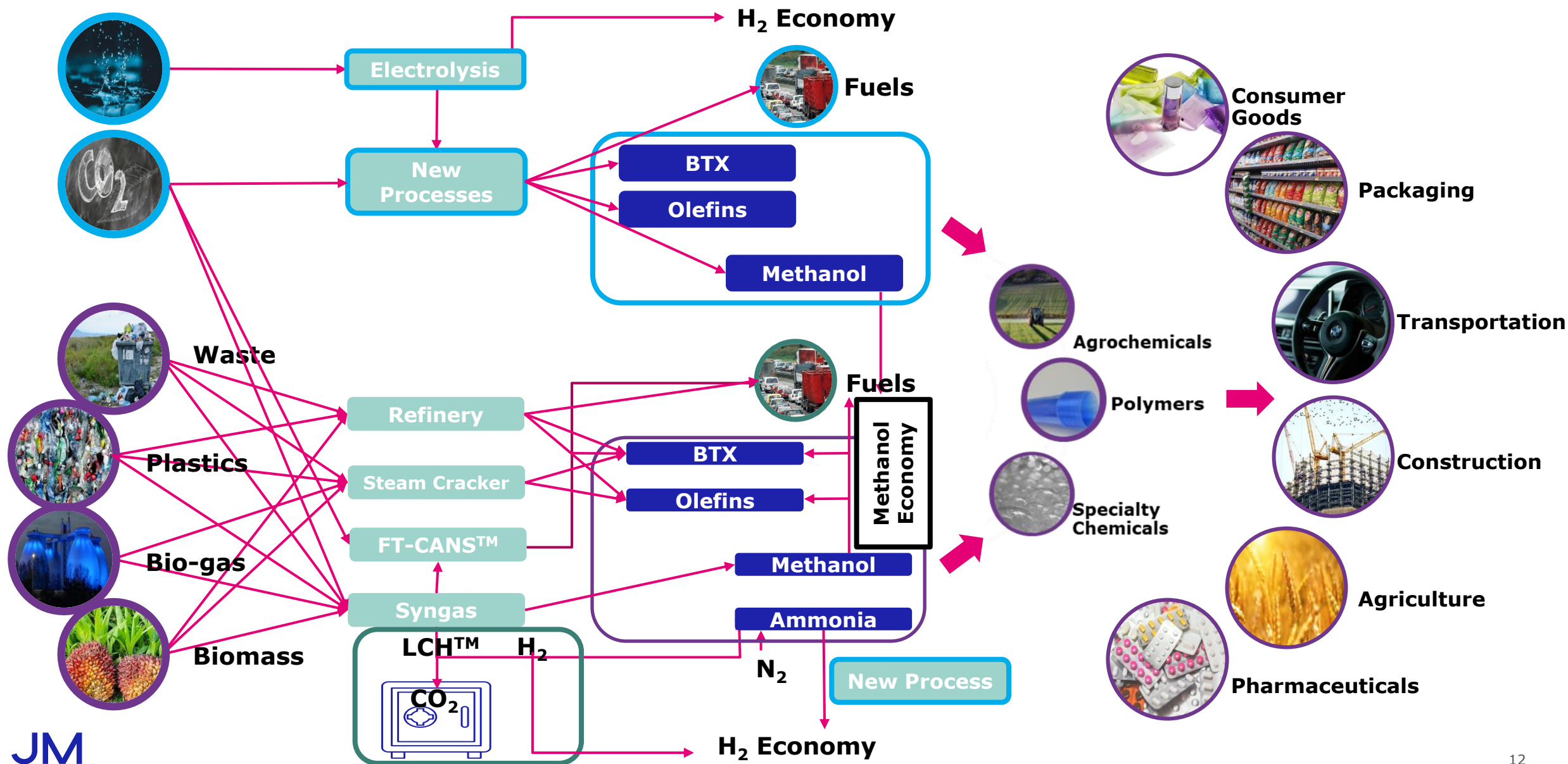
- ✓ Expertise in catalysis and process design
- ✓ Flexible catalysts, which can be used with different feedstocks
- ✓ Haru-Oni Methanol Project



# Tomorrow...added complexity with R&D enabled new feedstocks



# The Future...requires R&D





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**“In science, the credit goes to the man  
who convinces the world, not the man  
to whom the idea first occurs.”  
– Sir Francis Darwin**

**Q&A**

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