Tailor-made Methanol

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Johnson Matthey
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Introduction to Johnson Matthey
Introduction to Johnson Matthey (JM)

Johnson Matthey

- Over 200 years old
- Over 13,000 employees worldwide
- Operate in a diverse range of markets – world class science and technology

Catalyst Technologies

- World leading technology licensing and catalysts for a wide portfolio of products

Methanol

- JM have supplied the methanol industry with both technology and catalysts for over 45 years
- Large range of technologies available tailored to suit every project
- Highly experienced in both natural gas, coal and other feedstock based methanol plants.
Natural Gas Based Methanol Technology
Methanol from natural gas

There are five main syngas production flowsheets JM offer:

1) Steam Methane Reformer (SMR) only
2) Steam Methane Reformer (SMR) plus CO\(_2\) addition
3) SMR plus Autothermal Reforming (ATR)
4) ATR plus H\(_2\) addition
5) Gas Heated Reformer (GHR) plus ATR

Syngas: \[ R = \frac{H_2 - CO_2}{CO + CO_2} \]
Reforming Flowsheet Summary
Pre-reformer (optional)
SMR
Typical syngas R Ratio – 2.9

Flowsheet Ads/Disads
➕ Established technology
➕ No ASU required
➕ Low CAPEX <3000 MTPD
➕ Good for heavy or high CO₂ NG
➖ Limited on capacity
➕ Lowest efficiency
Reforming Flowsheet Summary

Pre-reformer (optional)
SMR
CO₂ addition

Typical syngas R Ratio – 2

Flowsheet Ads/Disads

プラス  Established Technology
プラス  No ASU required
プラス  Low CAPEX
プラス  R Ratio 2 – medium efficiency

黒い  Requires CO₂ source

Flowsheets selection: SMR + CO₂
Reforming Flowsheet Summary

- Pre-reformer
- Fired Heater
- ATR
- Hydrogen import
- Typical syngas R Ratio – 2

Flowsheet Ads/Disads

- R Ratio 2 – High efficiency
- High single train capacities
- Low capex (only with H2 addition)

- Requires a large ASU
- Requires H2 Import

Flowsheets selection: ATR with hydrogen addition

Diagram:
- Natural Gas + Steam → ATR
- Oxygen → Heat Recovery
- R = 2.0
- Fired heater
- Syngas Compression
- Methanol Loop
- Methanol Distillation
- Methanol product
Reforming Flowsheet Summary

SMR

ATR

Typical syngas R Ratio – 2

Flowsheet Ads/Disads

+ R Ratio 2 – High efficiency
+ High single train capacities
+ No CO2 or H2 import required
- 10% higher capex than SMR only
- Requires a large ASU
**Flowsheets selection: GHR + ATR**

**Reforming Flowsheet Summary**
Gas Heated Reformer (GHR)
ATR
Typical syngas R Ratio – 2

**Flowsheet Ads/Disads**
- No HP Steam production
- R Ratio 2 – Highest efficiency
- Lowest CAPEX of any flowsheet
- Can incorporate renewable electricity
- Currently no large scale reference
## Flowsheet Comparison

A comparison summary table is provided below for JM’s main reforming technologies:

<table>
<thead>
<tr>
<th></th>
<th>SMR Only</th>
<th>SMR + CO2</th>
<th>SMR + ATR</th>
<th>ATR + H2</th>
<th>GHR and ATR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capex</strong></td>
<td>Benchmark</td>
<td>Benchmark</td>
<td>Higher than Benchmark</td>
<td>Lower than Benchmark</td>
<td>Lower than Benchmark</td>
</tr>
<tr>
<td><strong>Nat Gas Consumption (GJ/T, LHV)</strong></td>
<td>32</td>
<td>31</td>
<td>29.7</td>
<td>28.9 (30.5 including H2 LHV)</td>
<td>29.3 with gas turbine</td>
</tr>
<tr>
<td><strong>JM Offer</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>JM Examples</strong></td>
<td>Geismar 1 + 2</td>
<td>M5000</td>
<td>Emethanex</td>
<td>Methanex Geismar 3</td>
<td>Coogee, NWIWK</td>
</tr>
<tr>
<td><strong>Max Train Capacity</strong></td>
<td>4,100 MTPD</td>
<td>5,600 MTPD</td>
<td>10,000 MTPD</td>
<td>10,000 MTPD</td>
<td>5,000 MTPD</td>
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<tr>
<td><strong>Reliability</strong></td>
<td>Higher than benchmark</td>
<td>Higher than benchmark</td>
<td>Benchmark</td>
<td>Benchmark</td>
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<tr>
<td><strong>Comments</strong></td>
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<td>JM recommends where CO2 readily available</td>
<td>JM recommends where CO2/import H2 not readily available or Nat Gas price high</td>
<td>Most appropriate for situations with external source of import hydrogen such as existing methanol synthesis loop purge</td>
<td>Most appropriate for situations with cheap electricity</td>
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<td>32.3</td>
<td>31.0</td>
<td>30.1 (31.8 including H2 HHV)</td>
<td>30.5 with gas turbine</td>
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<td>(mmBTU/metric T, HHV)</td>
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Conclusions

• The best flowsheet is project dependent

• JM offer a range of syngas production technologies – tailor-made

• Balance between Capex and Opex – client preference