GSTC Global Syngas Database

Global Syngas Technologies Conference
Austin, 29th October 2019
Overview

• Introduction
• Updated evaluations
  • Syngas
  • Gasification
  • Reforming
• Conclusions
GSTC Database

• First edition 1999 as global gasification database
• Updated regularly since then
• 2016 Separate database for steam-methane reforming
• 2017 Update for Gasification
  • Total 1,099 projects, 2,886 gasifiers, of which:
    • Active commercial operating and planned 379 projects, 938 gasifiers
    • 173 GW$_{th}$ operating, 108 GW$_{th}$ under construction and 116 GW$_{th}$ planned.
• 2018 Integration of gasification and reforming databases
• 2019 Update with total 2,433 projects, of which
  • 1,286 gasification projects with 3,173 gasifiers
  • 1,137 reforming projects with 1,270 reformers

• Available on-line to members

Note: Total database includes shutdown gasifiers, gasifiers never built or only in pre-planning stage, as well as pilot and demonstration gasifiers.
Total Syngas Market

- Ammonia: 46.0
- Methanol: 36.5
- Refinery H2: 21.7
- Other H2: 6.4
- SNG: 3.0
- Electricity: 6.2
- Liquidfuels: 15.2
- DRI: 8.4
- Chemicals: 2.4
- Other: 3.2

Data in MM Nm³/h

Source: GSTC Database, 2019
Syngas from SMR and ATR Technologies

Data in $\text{MM Nm}^3/\text{h}$

Source: GSTC Database, 2019
Syngas from Gasifiers

- Ammonia: 10.9 MNm³/h
- Methanol: 20.8 MNm³/h
- Refinery H2: 3.8 MNm³/h
- Other H2: 0.0 MNm³/h
- Electricity: 6.2 MNm³/h
- Liquid fuels: 12.4 MNm³/h
- SNG: 3.0 MNm³/h
- DRI: 0.3 MNm³/h
- Chemicals: 2.2 MNm³/h
- Other: 3.2 MNm³/h

Data in MNm³/h

Source: GSTC Database, 2019
Syngas Market Development  2016-2018

Operating plants only

Source: GSTC Database, 2019
Market Share by Technology Type

Source: GSTC Database, 2019

**Million Nm³/h Syngas**

- **Ammonia**
  - Reforming
  - Gasification

- **Methanol**
  - Reforming
  - Gasification

Source: GSTC Database, 2019
What’s New in 2019 Database - Gasification

• Total 1,286 projects with 3,173 gasifiers not counting spares, of which:

<table>
<thead>
<tr>
<th>Commercial</th>
<th>Projects</th>
<th>Gasifiers</th>
<th>GWₜₜ Syngas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>539</td>
<td>1,179</td>
<td>214</td>
</tr>
<tr>
<td>Construction</td>
<td>136</td>
<td>371</td>
<td>109</td>
</tr>
<tr>
<td>Planned</td>
<td>148</td>
<td>682</td>
<td>115</td>
</tr>
<tr>
<td>Total</td>
<td>823</td>
<td>2,232</td>
<td>438</td>
</tr>
</tbody>
</table>

Note: Total database includes shutdown gasifiers, gasifiers never built or only in pre-planning stage, as well as pilot and demonstration gasifiers.

Source: GSTC Database, 2019
Cumulative Capacity with Probable Increase

MW, Synthesis Gas

- Planned (2023)
- Construction (2021)
- Operating (2019)

Source: GSTC Database, 2019
Gasification by Region

Source: GSTC Database, 2019
End Use Applications of Syngas

Source: GSTC Database, 2019

MWth Synthesis Gas

- **Chemicals**
  - Planned (2023)
  - Construction (2021)
  - Operating (2019)

- **Liquid fuels**

- **Power**

- **Gaseous fuels**

Source: GSTC Database, 2019
Primary Feedstocks for Gasification

Source: GSTC Database, 2019

MWth Synthesis Gas

- **Coal**: Planned (2023), Construction (2021), Operating (2019)
- **Petroleum**
- **Gas**
- **Petcoke**
- **Biomass**
- **Waste**

Source: GSTC Database, 2019
Primary Non-Coal Feedstocks for Gasification

Source: GSTC Database, 2019

MW th Synthesis Gas

- Petroleum
- Gas
- Petcoke
- Biomass
- Waste

Planned (2023)
Construction (2021)
Operating (2019)

Source: GSTC Database, 2019
Number of Gasifiers by Primary Feedstocks

- **Coal**: Planned (2023)
- **Petroleum**: Construction (2021)
- **Gas**: Operating (2019)
- **Pet coke**: Operating (2019)
- **Biomass**: Operating (2019)
- **Waste**: Operating (2019)

Source: GSTC Database, 2019
Gasification by Technology

Source: GSTC Database, 2019
Gasification by Technology – Coal Feed Only

Source: GSTC Database, 2019
Biomass Gasification around the World

Source: GSTC Database, 2019

MWth Synthesis Gas

- Planned (2023)
- Construction (2021)
- Operating (2019)

Africa/ME  Asia/ Austr.  Cen./So. America  Europe  No. America

Source: GSTC Database, 2019
Biomass Gasifiers by Size

Number of Projects

Source: GSTC Database, 2019

Planned (2023)
Construction (2021)
Operating (2019)
2019 Database - Reforming

- Total 1,137 projects with 1,270 reformers, of which:

<table>
<thead>
<tr>
<th>Commercial</th>
<th>Projects</th>
<th>Units</th>
<th>GW_{th} Syngas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>896</td>
<td>1,023</td>
<td>270</td>
</tr>
<tr>
<td>Construction</td>
<td>37</td>
<td>41</td>
<td>18</td>
</tr>
<tr>
<td>Planned</td>
<td>64</td>
<td>67</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>997</td>
<td>1,131</td>
<td>322</td>
</tr>
</tbody>
</table>

Note: Total database includes shutdown reformers, reformers never built or only in pre-planning stage, as well as pilot and demonstration reformers. Database does not include a large number of smaller reformers (5,000 Nm³/h)

Source: GSTC Database, 2019
SMR/ATR Syngas by Application

Source: GSTC Database, 2019
SMR/ATR Syngas by Region

Source: GSTC Database, 2019
Conclusions

• Syngas market continues to grow
• Rate of growth beginning to slow down (in line with world economy)
• Regional differences continue to be noticeable in gasification
  • Coal in China, Biomass in Europe
• Reforming much more evenly spread
Acknowledgements

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• Any additions/corrections are always welcome
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