Gasification India 2018
29th – 30th Nov. 2018

Coal Gasification based Urea plant of Talcher Fertilizers Ltd.

Gasification Project Demonstration

J S SAINI
Chief Executive Officer
Game Changer for India

- Alternative avenue for vast consumption of high ash Indian coal
- Clean Coal Technology
- Reduced dependence on LNG
- Alternative route for production of NG equivalent syngas
More than 200 gasifiers are operating in China.

In 2014, China produced more than 80 MMTPA ammonia (40% of global ammonia production). More than 50% through coal gasification.
Cost of imported LNG ~ Rs. 55,000 cr. annually
Syngas production from coal will reduce annual import bill
Pooled NG Price and Coal Price Trends

* Provisional value for September 2018

NG

Coal

G 12 Coal Prices (Rs/MT)
Pooled Price (USD/MMBtu)
India is world’s 3rd largest CO2 emitter after China and USA

TFL is supporting alternative clean process to increase coal consumption which is falling as India eyes Paris 2016 goals
**Strategic Significance of the Project**

'Make-in-India' initiative with domestic coal feed to produce Urea

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Significance</th>
<th>Impact</th>
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<tbody>
<tr>
<td>1.</td>
<td>Development of eastern India</td>
<td>1st urea plant in Odisha</td>
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</tbody>
</table>
| 2.     | Utilization of indigenous source of energy (coal)| • Increased coal consumption  
                                    | • Reduced dependence on natural gas                                   |
| 3.     | Domestic Urea production                         | Import substitution of 1.27 MMTPA urea                                 |
| 4.     | Clean Coal Technology                            | • Supports Paris Agreement, 2016  
                                    | • Reduced emission of green house gases                               |
| 5.     | Reduced natural gas imports                      | 2.38 mmscmd NG equivalent syngas                                       |
| 6.     | LNG import saving                                | > Rs.1620 Cr. per annum                                                |
| 7.     | Lower volatility of coal price vis-à-vis natural gas – crude oil price | Being indigenous feedstock, minimum volatility in price of coal       |
| 8.     | Employment opportunities and skill development   | Direct/indirect – 4500  
                                    | During construction > 10,000                                        |
Project Location

- **Category of Project**
  - Revival, categorized with green field project of closed units of FCIL
- **Project Location**: Talcher, Odisha (140 km from Bhubaneswar)
# Project Configuration

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Facilities</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Coal Gasification &amp; purification</td>
<td>189,000 Nm(^3)/hr. = 1500 MNm(^3)PA (2.38 mmscmd of NG equivalent)</td>
</tr>
<tr>
<td>2.</td>
<td>Ammonia Synthesis</td>
<td>0.73 MMTPA (2200 MTPD)</td>
</tr>
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<td>3.</td>
<td>Urea plant</td>
<td>1.27 MMTPA (3850 MTPD)</td>
</tr>
<tr>
<td>4.</td>
<td>Sulphur Recovery Unit</td>
<td>30 KTA (95 TPD)</td>
</tr>
<tr>
<td>5.</td>
<td>Coal based power plant</td>
<td>90 MW (2 STG), Boiler 375 MT/hr (2+1),</td>
</tr>
<tr>
<td>6.</td>
<td>Offsite systems</td>
<td>DM water, CPU, Instrument &amp; Plant air, etc.</td>
</tr>
<tr>
<td>7.</td>
<td>Coal &amp; Petcoke requirements</td>
<td>Coal = 3.5 MMTPA Petcoke = 0.32 MMTPA</td>
</tr>
<tr>
<td>8.</td>
<td>Water requirement</td>
<td>Up to 14 MGD (Brahmani river)</td>
</tr>
<tr>
<td>9.</td>
<td>Investment</td>
<td>Rs. 11611 cr. (CG: Rs. 3963 + Rs. 7648) (D: Rs. 8128 cr. and E: Rs. 3483 cr.)</td>
</tr>
<tr>
<td>10.</td>
<td>Direct and indirect employment</td>
<td>• During construction (48 mths)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Direct in plant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Direct/indirect in coal mine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 10,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 500</td>
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</tbody>
</table>
Raw Material & Sources

Coal

- Source: 50% North Arkhapal Srirampur Mine

- Consumption:
  - Total: 7572 MTPD (2.5 MMTPA)
  - Gasification: 3331 MTPD (1.09 MMTPA)
  - CPP: 4241 MTPD (1.40 MMTPA)

- Transportation to Plant: via 10 km long conveyor

Petcoke

- Source: IOCL Paradip Refinery (200 km from Talcher)

- Consumption: 1000 MTPD (0.32 MMTPA)

- Transportation to plant: Railway and Road
Process Flow Diagram

Bhubaneshwari Coal Mine

Captive Coal from Arkhapal Mine

Coal

Feed Preparation

Fly Ash (10%)

Gasification Plant

Raw Syngas

Shift Reactor

Gas Purification

Ammonia Synthesis

Urea Production

Future Uses

CO₂*

Syngas

CPP & Offsites

N₂

Air Separation Plant

O₂

Sulphur Recovery

To market

Slag

90%

Air

Market

N₂

Urea

To market

*Balance CO₂ shall be captured
Gasification Technology

- Air Products Coal Gasification Technology – entrained bed technology
Challenges for Talcher Fertilizers

- Technology which can handle high ash content (up to 47%) of Indian coal

- Proximate Coal Analysis:
  - Moisture, % wt.: 5.00
  - Ash, % wt.: 43.50 (max. 47%)
  - Volatile, % wt.: 25.75
  - Fixed Carbon, % wt.: 25.75
  - Fluidity point, ºC: >1400
  - HHV MJ/kg: 16.81

- Plant can handle pure coal feed and petcoke blend up to 25%
Flexibility of Coal Gasification Process

- Plant shall normally operate on blend of 75% coal and 25% petcoke.
- Plant can handle variation in coal and petcoke blend.
- Plant equipments designed for 100% pure coal operation containing up to 47% ash – worst case scenario.
- Each gasifier can support 75% of plant load for continuous ammonia/urea production.
- Due to presence of syngas cooler in process, process yields high heat recovery.
Concept of Petcoke Blending

- Largely mitigates problems of high Ash content of Talcher Coal
- Petcoke: Low Ash, high heating value: Ash 0.1%, C 90%, 8500 kcal
- On mixing with Coal, improves stability of operation
- Petcoke blend reduces overall Ash content
- Shell technology provides flexibility of processing different proportions of Coal and Petcoke

<table>
<thead>
<tr>
<th>Coal Quality (Ash%)</th>
<th>Petcoke % in Blend</th>
<th>Resultant Ash % (approx)</th>
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<tbody>
<tr>
<td>43</td>
<td>10</td>
<td>38.7</td>
</tr>
<tr>
<td>43</td>
<td>15</td>
<td>36.6</td>
</tr>
<tr>
<td>43</td>
<td>25</td>
<td>32.3</td>
</tr>
<tr>
<td>40 (Bhubneshwari coal)</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>37 (TFL analysis)</td>
<td>25</td>
<td>28</td>
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</tbody>
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North Arkhapal Srirampur Mine

- **Tentative Geological reserves**: 920 million ton
- **Block area**: 11.7 sq. km
- **Tentative grade of coal**: G 9 to G 14
- **Coal field**: Talcher, Angul Odisha
- **Status of mine**: GR report for DFR by M/s CMPDI in Jun., 19
- **Bridge Linkage for start up**: Bhubneswari coal mine
- **Ash content**: 35 to 47% (avg. 40%)
Strategy for Technology Expansion

- Strategy for technology expansion
  - Clue from China coal gasification technology expansion. 121 operating plants and 57 under construction coal gasification plants
  - Total 400 gasifiers (322 in China). 11 built by L&T
  - About 300 mmcmd equivalent NG production in China
  - China coal consumption 10 MTPD, India is 2 MTPD
  - China consumption in gasification is 1.6 MTPD
  - Additional 11 Gasifiers proposed, 13.2 mmcmd NG equivalent
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<tr>
<th>Sl.</th>
<th>Description</th>
<th>Timelines</th>
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<tbody>
<tr>
<td>1.</td>
<td>Duration of project</td>
<td>41 months</td>
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<td>2.</td>
<td>Start of pre project activities</td>
<td>Aug. 2017</td>
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<td>3.</td>
<td>Award of critical jobs for site enabling</td>
<td>Work in progress</td>
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<tr>
<td></td>
<td>• Site grading</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Construction power</td>
<td></td>
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<td></td>
<td>• Construction water</td>
<td></td>
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<tr>
<td>4.</td>
<td>Finalization of Gasification and Ammonia/Urea tender</td>
<td>Jan. 2018</td>
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<td>5.</td>
<td>Revision of DFR and Financial Closure</td>
<td>Feb. 2019</td>
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<tr>
<td>6.</td>
<td>Award of Gasification and Ammonia/Urea tender</td>
<td>Mar. 2019</td>
</tr>
<tr>
<td>7.</td>
<td>Zero Date</td>
<td>Mar. 2019</td>
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<tr>
<td>8.</td>
<td>Mechanical completion (MC) (36 months)</td>
<td>Mar. 2022</td>
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<td>9.</td>
<td>Commissioning (5 months from MC)</td>
<td>Aug. 2022</td>
</tr>
</tbody>
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Inauguration of commencement of works by Hon’ble Prime Minister of India on 22nd September 2018
Value Addition Plans (Future)

- Provision of conversion of excess Syngas (100,000 Nm3/d) into methanol and other chemicals

- Provision of additional gasifier for natural gas production/methanol

- Sulphur enhancing purification unit – lumps to granules

- Production of melamine from urea
Thank You