Air Products dry-feed coal gasification process and Lu’An project update

For Gasification India conference 2019

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A proven technology on an ever-increasing scale

Coal feed ton/day

- Lu’an (3200 t/d)
- YTH, Datang (2700 t/d)
- Datong (2400 t/d)
- Yueyang JV (2000 t/d)
- Guangxi Liuzhou (1200 t/d)
- YTH Jinxin BQ (1100 t/d)
- Wison Nanjing BQ (1000 t/d)
- Hubei Shuanghuan (900 t/d)

**Timeline of Gasification Licensees**

- 1976: Pilot unit, Amsterdam NL
- 1978: Demo unit, Harburg, Germany
- 1987: SCGP-1, Houston, USA
- 1993: IGCC, Buggenum, NL
- >2000: Gasification Licensees, China, Vietnam etc.
Air Products dry-feed coal gasification technology was licensed for 32 applications globally, including IGCC power plants and chemicals’ production.

20 years of commercialization.

Two coal gasification projects are operated in a “sale of gas” mode.
New project:
Talcher fertilizers limited high ash coal

Located at Odisha, **India**

- Final products are 2200 tpd ammonia, and 3850 tpd urea*.
- Air Products dry feed coal gasification, for gasifying blend of high-ash coal (ranging from **40% to 47% ash**) and petcoke (25% maximum in the feed blend).

* Quoted from [http://tflonline.co.in/](http://tflonline.co.in/)
Air Products dry-feed Gasification Technology Portfolio
One Proven Technology: TWO LINE-UPS

- Industrially proven, mature technology
- Carbon efficiency >99%
- Highest energy efficiency, lowest consumption
- High-level steam as a very useful ‘byproduct’
- Environmental: reduced water consumption, less waste water

- Same basic design as syngas cooler line-up
- Carbon efficiency >99%
- Simplified line up, reduced Capex
- Even wider coal flexibility
- Easier operation and maintenance, high reliability
**Mature core of the technology: Membrane wall with multiple burners**

- Syngas and flyash leave at the top
- Membrane wall protected by slag layer
- Multiple (4-6) opposed burners
- Slag leaves at the bottom

**FEATURES AND BENEFITS**

- Long residence time, **high carbon conversion and low oxygen/coal consumption**
- High capacity of single gasifier, **easy scale up by multiple burners**
- Less erosion to coal burner, **long lifetime of burner**
- Better slag coverage, **less Energy loss and long lifetime of membrane wall**
Proven experience of high-ash coal operation

FEED FLEXIBILITY
- Handled over >200 different kinds of coal covering the whole reactivity spectrum from lignite to anthracite, ash contents from 6–37%

DEEP INSIGHT IN PROCESS
- Based on extensive operating experience, several modelling tools were developed to confidently assess novel coals and optimize coal blends

HIGH-ASH COALS
- Several sites are operating high ash coals up to 25–30% at the burner feed
- Few sites even operated on higher ash-content coals (up to 35%), but for economic reasons they turned to pet coke blending
Top-quartile operation performance in 2018

2018 overall reliability:
- Overall APSS plant reliability in 2018 is **98.4%**, the highest to-date.

Performance highlights:
- Longest A run (continuous run without stop): **265 days**
- Longest B run (run with short stop < 24 hours): **296 days**
- 18 sites achieved **>300 on-stream days** per year, with a max **351 days** in operation
Air Products & Lu’An Clean Energy Company
A coal-to-syngas production joint venture

JV: Air Products Lu’An (Changzhi) Co., Ltd – Shanxi, China
- Ownership = 60% APD / 40% Lu’An
- 4x3,200 t/d coal capacity APSS dry-feed gasifiers
- 4x3,000 t/d oxygen capacity Air Products ASUs
- Gasification supplies 825,000 Nm³/hr of (CO+H₂)
Air Products dry-feed coal gasification process
As applied in the Air Products Lu’An plant

MILLING/DRYING

SUPERHEATED MP STEAM

MP STEAM

COAL QUENCH GAS

Gasifier

RAW SYNGAS

900°C

1,600°C

SLAG

WET SCRUBBING

RAW SYNGAS

WATER TREATMENT

FLYASH SYSTEM

HPHT FILTER

FLYASH TO STORAGE

COAL FEEDING

COAL
Air Products Lu’An gasification operation key milestones
A journey to success

G1/G2 Initial start up
August 2018
Air Products takes the lead on the gasification plant

G1 212 days continuous run, Oct 2019

G2 125 days continuous run, Mar 2019

G3 140 days continuous run, Oct 2019

Availability ~95%, 2019
Air Products Lu’An Gasification performance
High efficiency

Anthracite coal, 20% ash content

- Carbon conversion: >99%
- Carbon in slag: <0.5%
- Carbon in flyash: <3%
- Gasifier availability*: ~95%
- Syngas load to downstream: 100%
- Slag to flyash ratio: 5:1

*Availability: Average of four gasifiers in 2019, excluding planned turnaround
Reached high availability in a short time
Collaboration of disciplines with different expertise

AP Lu’An operation

Gasification know-how, own technology

Professional Design and Engineering

Experienced project team

Professional commissioning team

Skilled operation team

Professional operation technical support

Operation Excellence

CONFIDENTIAL
Summary

1. Air Products provides world-class gasification technologies with the **highest efficiency, highest carbon conversion and low emissions**, contributing to a cleaner energy future.

2. As committed, Air Products Lu’An “sale of gas” gasification project achieved a **high availability within one year**.

3. Our **dedicated gasification teams** offer comprehensive and experienced support in all phases of a project.
Thank you
tell me more