Advancements in Slurry Gasification

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Gasification is energy conversion

**Fuel**
- **Solids**
  - Coal
  - Pet coke
  - Low rank coal
  - Biomass
- **Gas**
  - Low-cost NG
  - Off-gases
- **Liquids**
  - Oil
  - Residues

**Gasification system**
- Fuel Prep
- Heat Recovery
- Cleanup
- O₂

**Downstream**
- Methanol
- Oxochemicals
- Hydrogen
- Ammonia
- Liquid Fuels

Substitutes e.g. Direct Liquefaction, SMR
GE has 145 gasifiers in commercial operation ... the largest fleet in the industry ... with 85 additional gasifiers in design, engineering, or construction at 25 plants ... and a global presence in 15 different countries.
Licensed fleet growth in China since 2010

Methanol & Derivatives

Ammonia & Urea

Hydrogen & Other

Coal

Coke

Oil

In Operation

In Design/Construction
Historical factors driving China growth

- Low cost, flexible, highly **reliable** technology
- **Proven** at scale & pressure
- **Credible** technology introduction process
- Strong **DI relationships**
- Highly **localized** hardware
- Broad **installed base** with capable operators
- **Short build cycle** – 36 mo

... contract to first-fire

12FYP ... all of this + greater capital and operating efficiency ... more advanced technology
Slurry vs. Dry Feed for entrained flow

**Slurry-Fed Entrained Flow Gasification**
- Coal is ground and mixed with water & additives to form a slurry ... typical concentrations between 55-70%.

**Benefits/challenges**
- ✓ Highly scalable in pressure & throughput
- ✓ Low cost and highly reliable
- ✓ Highly flexible operating capability
- □ Traditional slurry prep technology not well suited for higher moisture coals
- □ Higher water consumption
- □ Lower thermal efficiency

**Dry-Fed Entrained Flow Gasification**
- Coal is ground and conveyed directly to the gasifier. Advanced cooling systems manage temp/slagging.

**Benefits/challenges**
- ✓ Higher thermal efficiency
- ✓ Lower water consumption
- ✓ Suitable for higher moisture coals
- □ Throughput & pressure scale costly and difficult.
- □ Higher capital cost & lower reliability
- □ Low operating flexibility ... particularly sensitive to feedstock changes.

How do we enhance slurry-fed technology while retaining its benefits?
Technology Advancement: Scaled gasifier

- Significant CAPEX reduction
- Optimized performance
- Minimized entrainment
- Proven in US IGCC
- Can reduce project risk

10-15% reduction in CAPEX
GE’s HP Quench Gasification Technology:

- Pressures up to 87 bar
- 5 – 10% reduction in MeOH cost
  - Syngas compression Aux Loads, MP, LP Steam for shift / AGR
- 5% reduction in coal to MeOH capex
- Number of trains
- HFO, Vac Resid, NG, and coal experience

5-10% reduction in methanol cost + creation of 18MW of internal power
Technology Advancement: RSC for HP steam

- **Soot-blowers** – Removed from new configuration
- **Performance** – 30% increase in steam production through surface enhancements & increased steam & hot gas pressure
- **Size** – 9 ft longer, same weight, and 2 ft smaller diameter
- **Seal/N2 Purge** - Enhanced for robust operation and RAM
- **Convective Cooler** - Removed to increase availability
- **Internal Quench** – experience based configuration, favorable for sealing

Tampa Soot blower Deposits
Tampa Tube Cage Leak RCA
Inlet Fouling – Coating sample clean

Experience Based Improvements

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Control systems

控制系统

- Physics-based models for dynamic plant control
  机理模型用于工厂动态控制

- Plant simulator for optimization & operator training
  工厂模拟器用来优化和操作员培训

- Combined hardware + software testing & deployment
  整合硬件 + 软件测试和调度