KBR’s Transport Gasifier - Technology Advancements & Recent Successes

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KBR at a Glance

- A leading global engineering, construction and services company supporting the following markets:
  - Hydrocarbons
  - Civil Infrastructure
  - Government & Defense
  - Industrial
  - Power
  - Ventures

- 2009 Revenue: $12.1 Billion
- 50,000 employees in 49 countries
KBR Advantage

Global Reach
Ability to work in different world cultures

TIC Focus

EPC Contractor
PLUS Licensor

Technical Integration Knowledge

Large & Mega EPC Contractor

Corporate Hands-on Commitment & Focus

Mega Project PMC Experience

Confident Teams

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Technology Business

- Refining
- Olefins
- Chemicals
- Syngas
- Coal Gasification
- Advanced Chem Eng
KBR’s TRIG™ Gasifier is an Excellent fit for Low Rank & High Ash Coal

Total ~ 900 Billion Tons
Low Rank + High Ash > 50%

273 Billion Tons
Low Rank 54%

173 Billion Tons
Low Rank 58%

126 Billion Tons
Low Rank 46%

93 Billion Tons
Mostly High Ash

90 Billion Tons
Low Rank 48%
Leading the Way to the Next Generation of Coal Based Energy

- TRIG™ is based on KBR’s FCC technology and jointly developed by KBR and Southern Company with support from U.S. DOE

- KBR is focused on licensing TRIG™ for Industrial applications worldwide

- Southern Company is focused on licensing TRIG™ for IGCC/Power applications
TRIG™ and the Value Chain

Coal
- O₂/Air Steam
- J-Leg
- Standpipe
- Loop-seal
- Riser
- Ash

Syngas for DRI / Steel
- Cyclones

SNG

CTL Liquid Fuels

Chemicals/ Fertilizers

Syngas for Power

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Integrated CTL scheme for Maximum Liquids Production

Gasification/Syngas Generation

- ASU
- Coal Preparation
- O₂ Blown TRIG™ Gasifier
- Syngas Cooling
- Ash

Gas Cleanup

- COS Hydrolysis
- Sour Shift
- Water Recovery
- Mercury Removal
- AGRD
- CO₂ Compressor
- To BL

F-T and Product Upgrading

- F-T Synthesis
- F-T Upgrading
- Offgas Treatment
- Lin. Product
- H₂
Coal to Ammonia – TRIG™ and KBR Ammonia Technology

[Diagram of the process flow for converting coal to ammonia using TRIG™ technology, including steps for air separation, gasification, and ammonia synthesis.]
TRIG™ Projects Worldwide

- UND TRIG™ Pilot Plant, Grand Forks, ND, USA [1990s]
- Boyuan TRIG™, Sunite, Inner Mongolia, China [2012]
- Mississippi Gasification Project, Kemper County, MS, USA [2014]
- PSDF TRIG™ Demo Unit, Wilsonville, AL, USA [1990s]
- Dongguan TRIG, Dongguan, Guangdong Province, China [2011]
- TRIG™ Pilot Plant Project, South Korea [2010]
Project Updates

Dongguan, China TRIG™ Project – 2011 Start-up

> Plant owned and operated by Dongguan Tian Ming Electric Power Co., Ltd (TMEP)
> 1 TRIG™ gasifier to produce clean syngas for 120 MW IGCC
> KBR and Southern providing Basic Engineering, Proprietary Equipment, and Startup Services
> Gasifier Design Completed and Long Lead Equipment on Order

Recent TRIG™ award – Inner Mongolia, China

> Client: Xilinguole Sunite Alkali Industry Co., Ltd, a subsidiary of Boyuan (Berun) Holdings Group, Ltd.
> High Ash Lignite Feedstock from nearby mine
> 1 oxygen-blown TRIG™ gasifier to produce syngas for Ethylene Glycol Plant
> Start-up expected in 2012

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Carbon Capture & Storage

> Pre-Combustion
  - Gasification
  - Syngas for Ammonia
  - Gas Processing
  - LNG
  - Refining

> Post-Combustion
  - Power
  - Flue Gas Clean-Up
  - Cement

> KBR CCS Projects
  - In Salah Gas (1 MTPA CO₂)
  - Gorgon (3 MTPA CO₂)
  - Pre-FEED → EPC scope
TRIG™ an Efficient & Reliable Clean Coal Technology

- Simple Design, Low Cost Materials
- Lignite & High ash - 100% Utilization
- Adv. Coal feed & Ash systems
- Flexible with alternate Feedstock
- 60 years of FCC Experience
- Capacity up to 4,000 mtpd coal
- Low CAPEX & OPEX
- Compact Plot Area
- Innovative Sparing Philosophy
- Low Water Use & Effluents

Unique Patented Process

Simple Operation & Robust Gasifier