SFGT Facilities in Freiberg, Germany
History of Siemens Fuel Gasification Technology

- 1978 DBI
- 1990 Preussag Noell
- 2000 Babcock Borsig Power
- 2010 Future Energy / Sustec

- Located in Freiberg, Germany (40 km south-west of Dresden)
- Initial technology development with focus on low-rank, high-ash lignite
- First commercial plant with start-up in 1984, operated on lignite, coal and various residuals
- Own test plants (5 MW<sub>th</sub> gasifier, feeding system, fuel analysis)

More than 20 years of successful operating experience
Siemens Fuel Gasification Technology

Plant Design and Siemens Energy Scope

**Fuel**
- Coal
- Lignite
- Petcoke
- Refinery residues
- Biomass

**Gas Island**
- Fuel preparation
- Air Separation Unit
- Gasifier Island
- CO Shift
- Sulfur Removal
- CO₂ Removal

**Applications**
- **Combined Cycle**
  - Power
- FT Synthesis
  - Transportation fuels
- Methanol Synthesis
  - Methanol
- Ammonia Production
  - Ammonia / Fertilizer
  - Hydrogen

**Chemicals and Synfuel Production**

- Siemens Basic Engineering & Design
- Siemens Supply of Key Equipment
- Siemens EPC

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Schematic of Gasifier Island

Process Design Package and Basic Engineering for

- Gasifier
- Feeding System
- Raw Gas Treatment
- Black Water Treatment
- Slag Discharge and Handling

Equipment Supply
Siemens Fuel Gasification (SFG) Technology Highlights

Dry feeding
- high efficiency
- high carbon conversion rate (> 98 %)
- can process low-rank coals

Cooling screen
- short start-up / shut-down
- low maintenance
- high availability

Full quench
- simple and reliable
- ideal for CO sour shift

Multi-fuel gasifier
- accepts a wide variety of fuels (e.g., bituminous & sub-bituminous coal, lignite, biomass, liquids)
- tar-free raw gas
Unique Cooling Screen Technology

Advantages

- Enables reduced reactor dimensions
- Leads to higher availability
- Self protecting
- Self-renewal of protection layer

![Diagram of cooling screen technology with membrane wall, pressurized water, ramming mass, and pipe coil with studs.]

![Graph showing temperatures of water, tube, ramming mass, and slag over time.]
Test facilities in Freiberg

- Gasifier reactor with cooling screen, 3-5 MW, max. 30 bar
- Different fuel feeding systems (300 kg/h)
  - Pulverized fuel dosing & feeding system
  - Slurry feeding
- Inert gas plant, 1000 Nm$^3$/h, 80 bar
- Oxygen supply unit, 300 Nm$^3$/h, 80 bar
- Full gas treatment
  - Desulphurization unit (Sulfoxx)
  - COS hydrolysis
  - HCN hydrolysis
- Waste water treatment
Testing facilities in Freiberg (Germany)

- Gasification tests with solid or liquid fuels
  - Determine plant specific data and gasification process characteristics
- High pressure test rig for solid fuel feeding
  - Test alternative coal flow measurement technologies
  - Investigate fluidization behavior under elevated pressure conditions
  - Test alternative dry feeding systems
- High temperature viscometer
  - Measure of slag melting behaviour
- Equipment for instrumental fuel analysis
Performance of SFG with different feedstocks

- More than 100 gasification tests performed with more than 60 different feedstocks
- Coals from Australia, Germany, Canada, South Africa, China,…
- Used to determine gasification behavior for fuels with difficult ash properties

Test results confirm that SFG offers widest fuel flexibility

- Anthracite
- Bituminous coals
- Sub-bit. coals
- Lignite
- Petcoke
- Tar oils
- Biomass
To Test or Not to Test

Customer Inquiry

Coal known

no

Ultimate / Proximate Analysis
Determination of Ash Fusion Temperature

Coal and Ash properties known

no

Slag Viscosity and Deeper Coal Analysis (e.g. Petrological)

yes

no

Determination of Moisture Level and Particle Size Distribution

yes

Fluidisation Tests

Gasification Tests for high Ash Containing Coals or critical Fusion Temperature

Basic Engineering Package and Project Execution
Liquid Residues: Gasification Project in the Czech Republic

Autothermal Oil Conversion Plant

**Client** Sokolovská uhelná, a.s.

**Location, country** Vřesová, Czech Republic

**Commissioning** 2008

**Technical data**

- **Type of reactor** Entrained-flow, cooling wall
- **Capacity thermal** 175 MWth
- **Pressure, temperature** 28 bar, 1400 °C
- **Type of quench system** Full quench

**Equipment / subsystems**

- **Feeding system** Liquid feeding
- **Gas cleaning** Spray scrubber
- **Soot water treatment** Depressurization and vapor condensation, sedimentation, chamber filter press

**Feedstock**

Generator tar and other liquid by-products of 26 fixed bed gasifiers

**Products / By-products**

Syngas to IGCC / slag, soot cake
Siemens Fuel Gasification Technology
Worldwide Activities

- Sherritt / EPCOR
  Lignite to Hydrogen & 380 MW<sub>e</sub> IGCC

- Summit Power
  600 MW<sub>e</sub> IGCC

- Secure Energy
  Coal to SNG, 1000 MW<sub>th</sub>

- HQ Freiberg
  Sales Office

- Vresova
  Test Facility

- Sustec, Schwarze Pumpe
  200 MW<sub>th</sub>, 1984

- NCPP, Coal to Polypropylene
  2500 MW<sub>th</sub>

- JinCheng
  Coal to Ammonia
  1000 MW<sub>th</sub>

- JV GSP China
  Siemens China Sales Office

- AEC
  Coal to Ammonia

Nine SFG-500 Gasifiers Being Manufactured,
Technology Selected and in Pre-Selection in Further Projects

As of 2008-04
NCPP: Largest Coal to Chemical Plant in China

5 x 500 MW<sub>th</sub> Coal to Polypropylen plant, based in Ningxia

Schedule:
- Contract signed Q1/2007
- Gasifier shipment 2008
- Start Commissioning 2009

Project Structure:
- Integrated Project Management Team consisting of SNCG and AMEC

Siemens Scope:
- Engineering and Gasification Testing
- Equipment Supply
  - Gasifiers, Burners, Feeder Vessels, ...
- Training
- Technical Field Assistance
Manufacturing of the first two gasifiers is finished
Fertilizer plant near Jincheng, China

2 x SFG-500 gasifiers for ammonia & urea production

**Customer:** Shanxi Lanhua Coal Chemical Co.,

**Products:** 300,000 t/year ammonia  
520,000 t/year urea

**Coal:** Anthracite  
(FT ~ 1400°C, ash content ~20 %)

**Siemens Scope:**

- Feedstock gasification tests
- Basic engineering
- Gasification technology license
- Equipment supply
- Technical Field Assistance

**Commercial operation:** Mid of 2010
Secure Energy Decatur Gasification Project

Project Summary

• 20 Billion SCF/year of Synthetic Natural Gas
• Feedstock: IL Bituminous Coal
• Expected Startup: 2010

Project Features

• Sulfur sold as by-product
• CO2-capture ready
• Integrated in existing project site:
  • Buildings
  • Water treatment
  • Coal handling
  • Infrastructure

Secure Energy Project Site in Decatur, IL

2 Gasifiers under Manufacturing
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