Gasification Can Play a Key Role in Energy Independence

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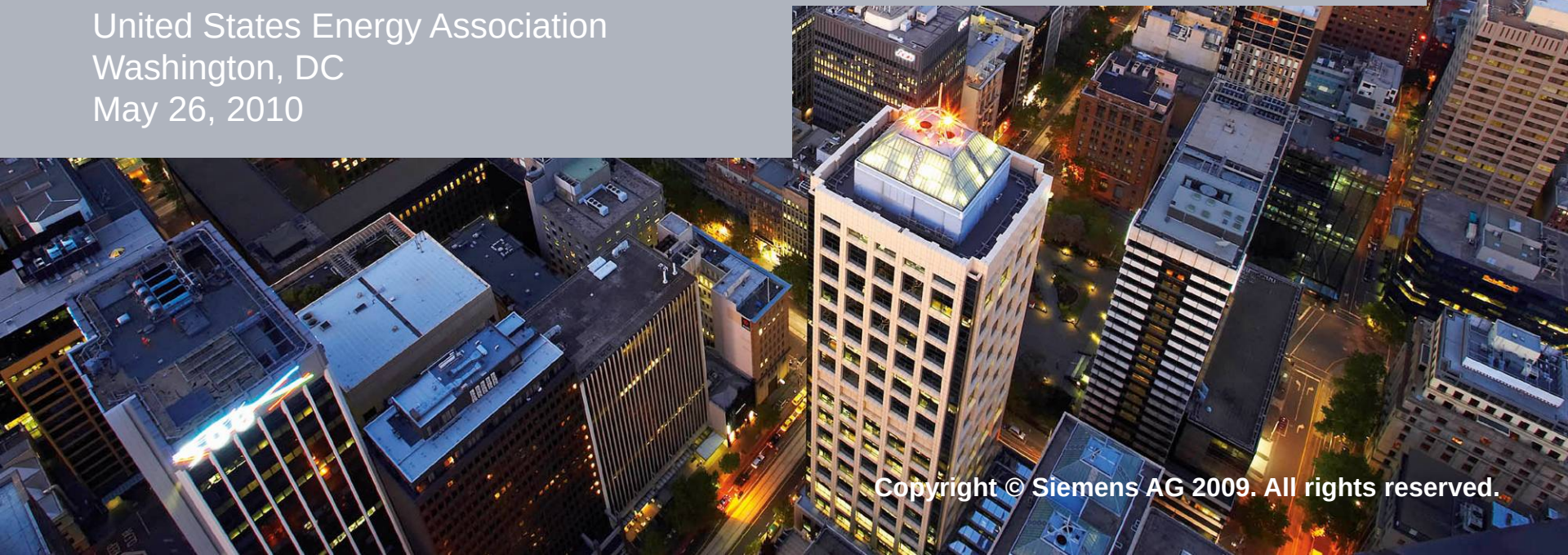
United States Energy Association
Washington, DC
May 26, 2010



Agenda

- Siemens Energy
- Gasification 101
- Market Status and Trends
  - Worldwide
  - China
  - United States
- Siemens Gasification
  - Projects
  - Technology
- Siemens Power Generation Technology
  - High H2 Turbine
- Conclusions
- Q&A

Siemens Sectors and Divisions

Sectors

Industry

Divisions

- Drive Technologies
- Industry Automation
- Building Technologies
- Mobility
- Lighting (OSRAM)
- Industry Solutions

Energy

Divisions

- Fossil Power Generation
- Renewable Energy
- Oil & Gas
- Energy Service
- Power Transmission
- Power Distribution

Healthcare

Divisions

- Imaging & IT
- Workflow & Solutions
- Diagnostics

Siemens Energy: Innovation fields along the entire energy conversion chain

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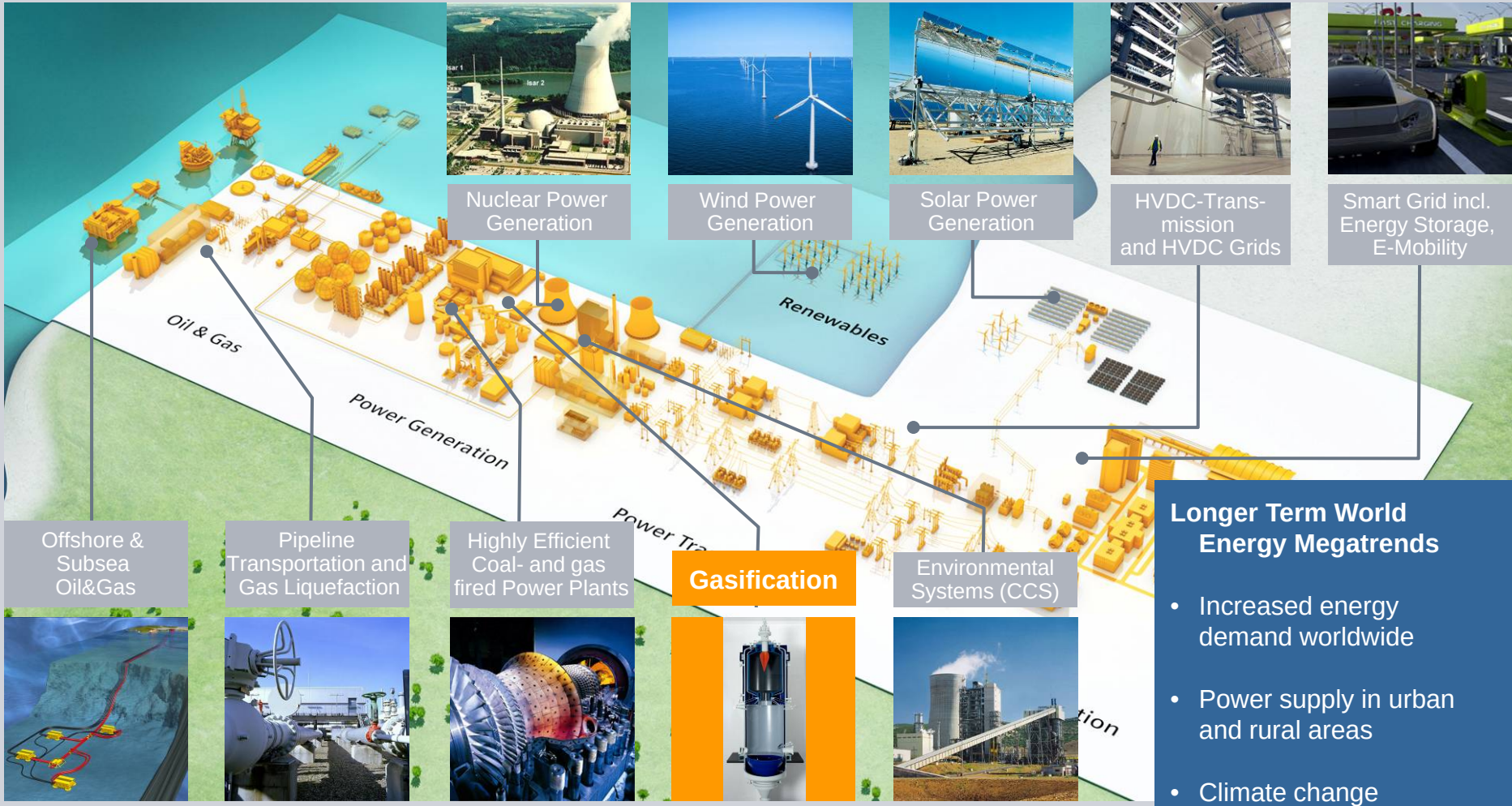

Longer Term World Energy Megatrends

- Increased energy demand worldwide
- Power supply in urban and rural areas
- Climate change
- Scarcity of fossil fuels

US Power Generation Market

Market Drivers

Flexibility to meet daily energy demand

Environmental considerations

- Improved efficiency
- Reduced water consumption
- Reduced air emissions

Today's designs must consider tomorrow's need.

Siemens Flex-Plant™ Natural Gas Fired Combined Cycle Series

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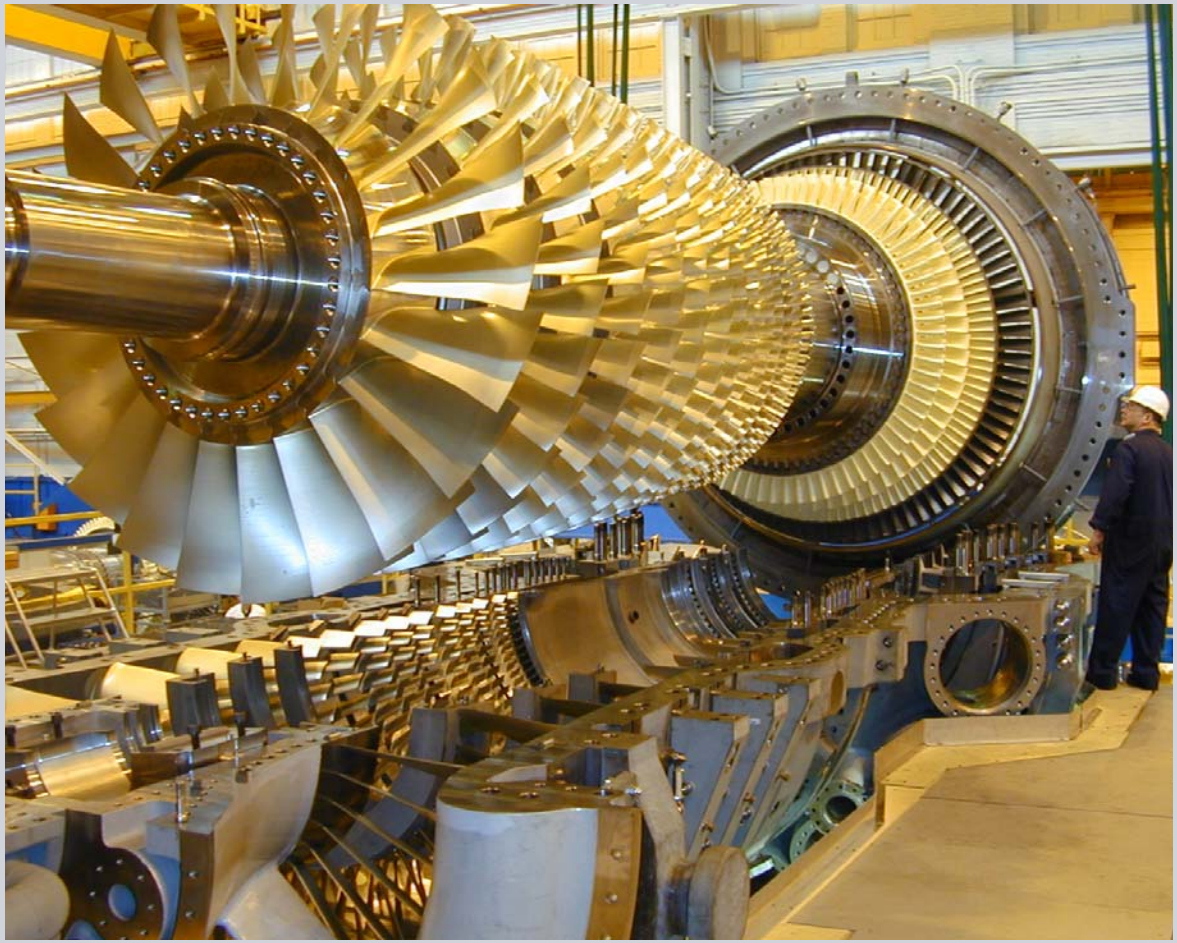
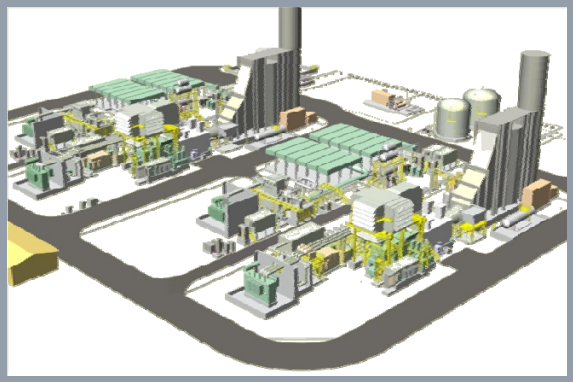
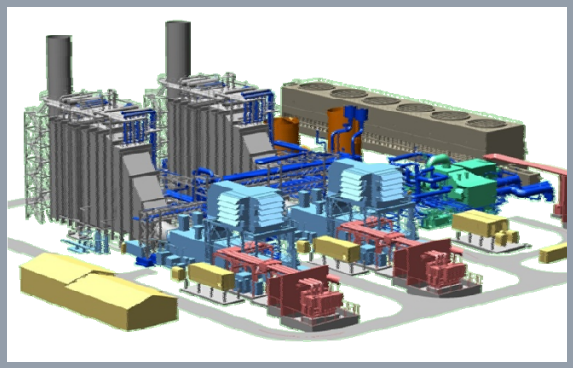


SGT6-5000F is the core of the Flex-Plant™ Series



1x1 SCC6-5000F Flex-Plant™10



2x1 SCC6-5000F Flex-Plant™30

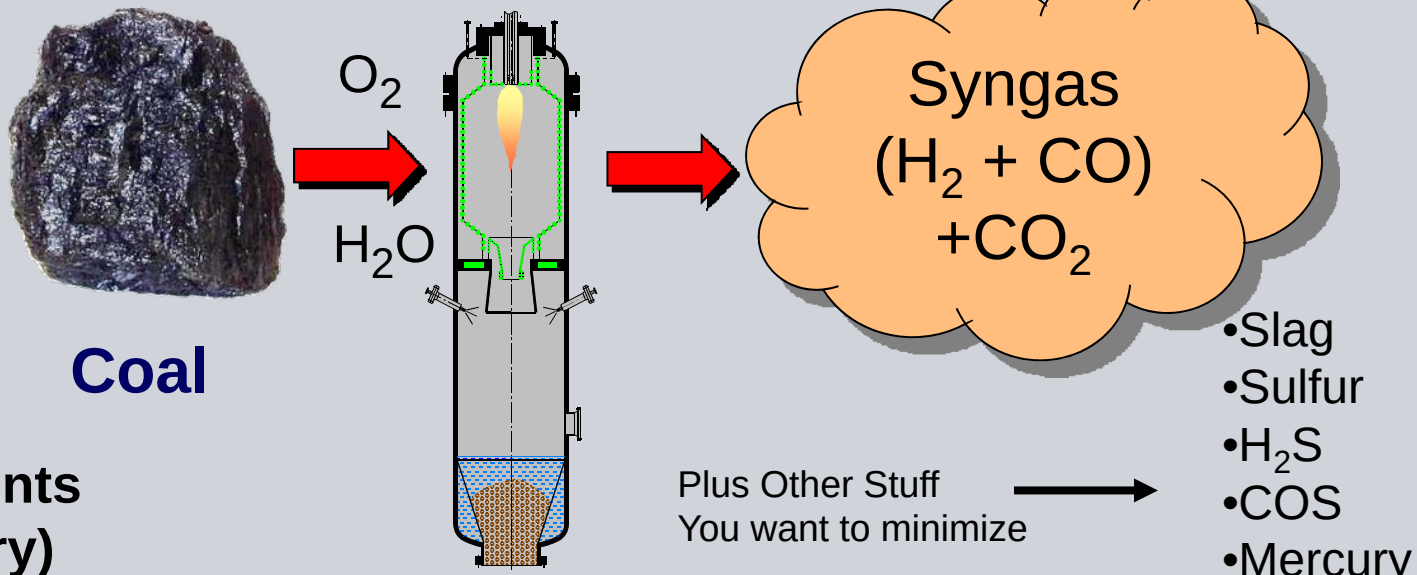
What is Gasification?

Coal is ….

- Carbon
- Ash (rock)
- Sulfur
- Nitrogen
- Hydrogen
- Water
- Trace Elements (e.g., mercury)

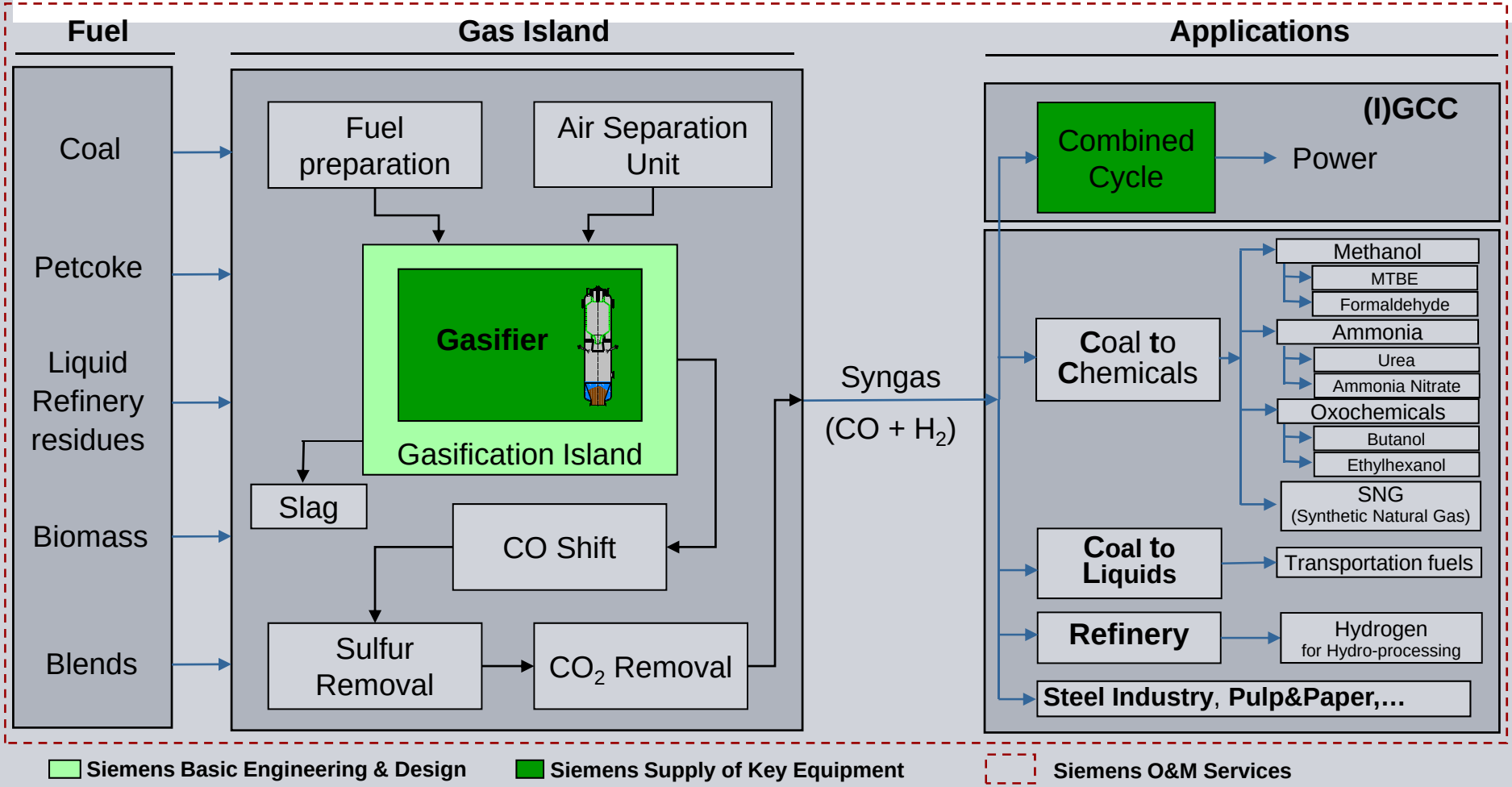
Gasification is ……

$$C + O_2 + H_2O \longrightarrow H_2 + CO + CO_2$$



Gasification is not Combustion

Gasification Plant Design and Applications



Gasification is able to meet the strictest environmental regulations:

Low emission of particulate matter, organic compounds and easy disposal of Sulfur

Can support the addition of capturing CO_2

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Products From Today's Gasification Projects

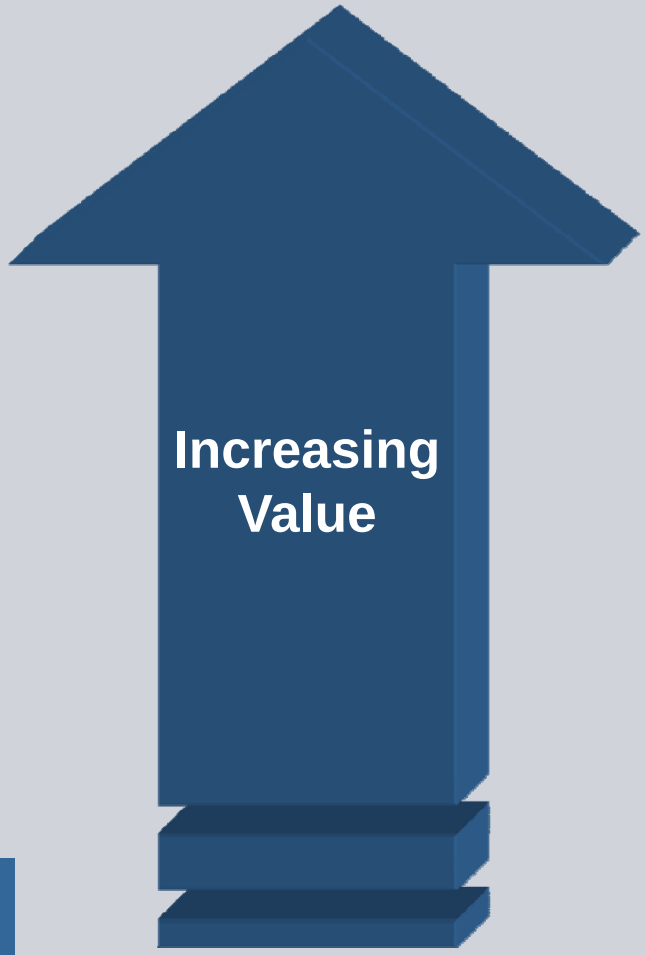
Hydrogen

Fischer-Tropsch fuels (diesel)

Ammonia
Methanol
Methyl acetate
Urea
Urea Ammonium Nitrate

SNG

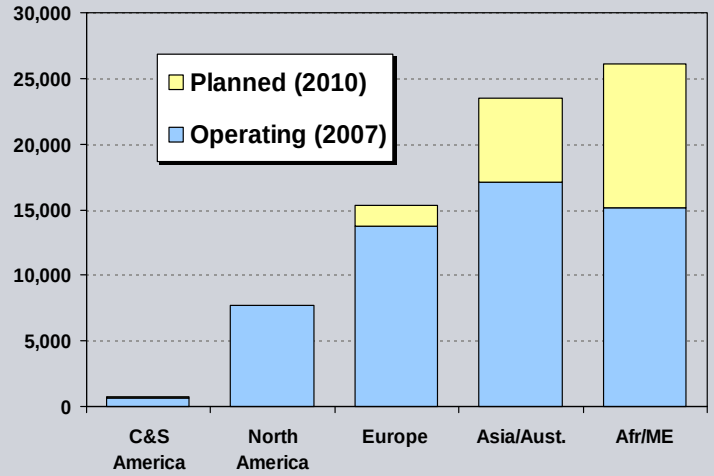
Power



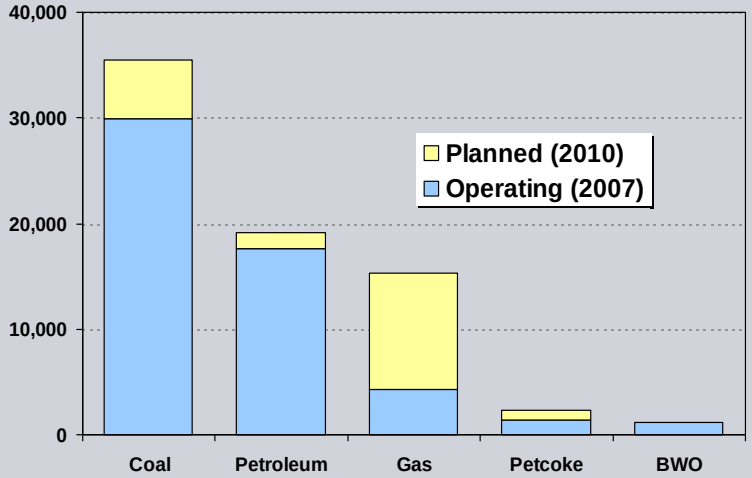
More Projects are Including Multiple Products
"Poly-Generation"

State of Gasification Worldwide

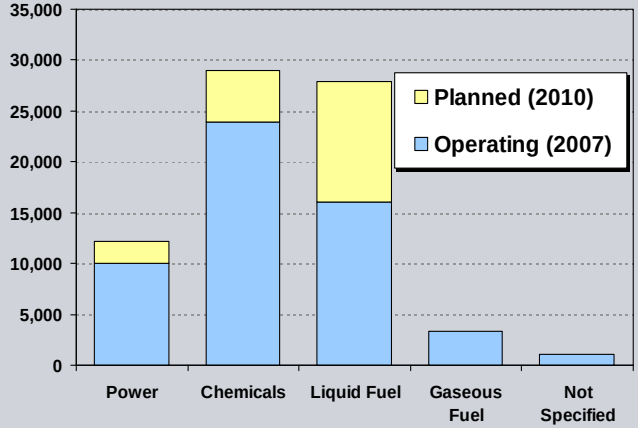
Geographical Distribution of World Gasification Capacity (MWth Equivalent)



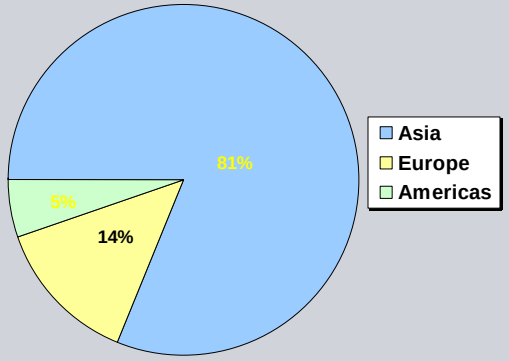
Feedstock Distribution of World Gasification Capacity (MWth Equivalent)



Product Distribution of World Gasification Capacity (MWth Equivalent)

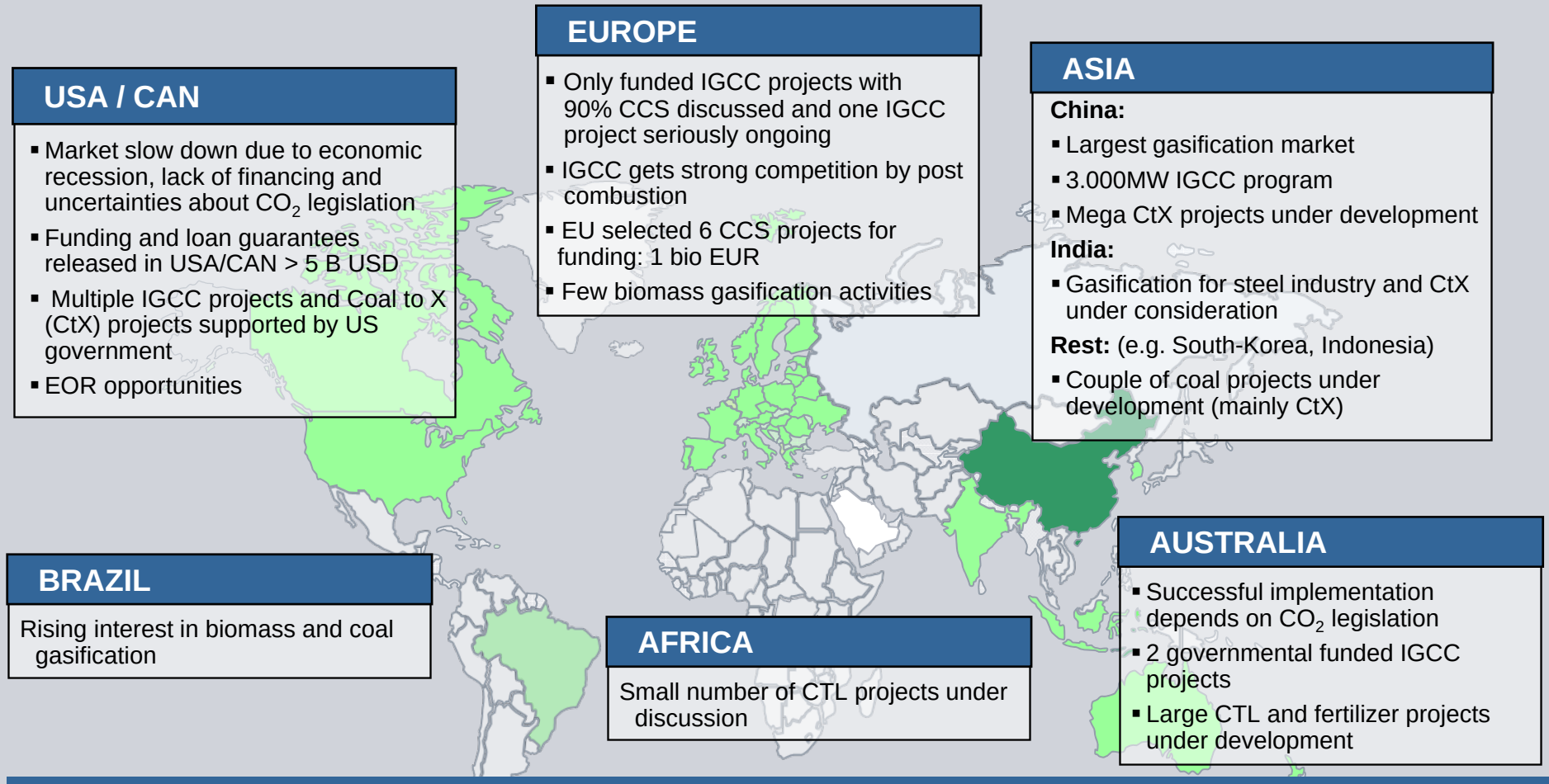


Shares of Growth in World Gasification Capacity 2004-2009 (without Pearl GTL)



Source: Gasification Technology Council (www.gasification.org)

State of Gasification Worldwide



USA / CAN

- Market slow down due to economic recession, lack of financing and uncertainties about CO_2 legislation
- Funding and loan guarantees released in USA/CAN > 5 B USD
- Multiple IGCC projects and Coal to X (CtX) projects supported by US government
- EOR opportunities

EUROPE

- Only funded IGCC projects with 90% CCS discussed and one IGCC project seriously ongoing
- IGCC gets strong competition by post combustion
- EU selected 6 CCS projects for funding: 1 bio EUR
- Few biomass gasification activities

ASIA

China:

- Largest gasification market
- 3.000MW IGCC program
- Mega CtX projects under development

India:

- Gasification for steel industry and CtX under consideration

Rest: (e.g. South-Korea, Indonesia)

- Couple of coal projects under development (mainly CtX)

BRAZIL

Rising interest in biomass and coal gasification

AFRICA

Small number of CTL projects under discussion

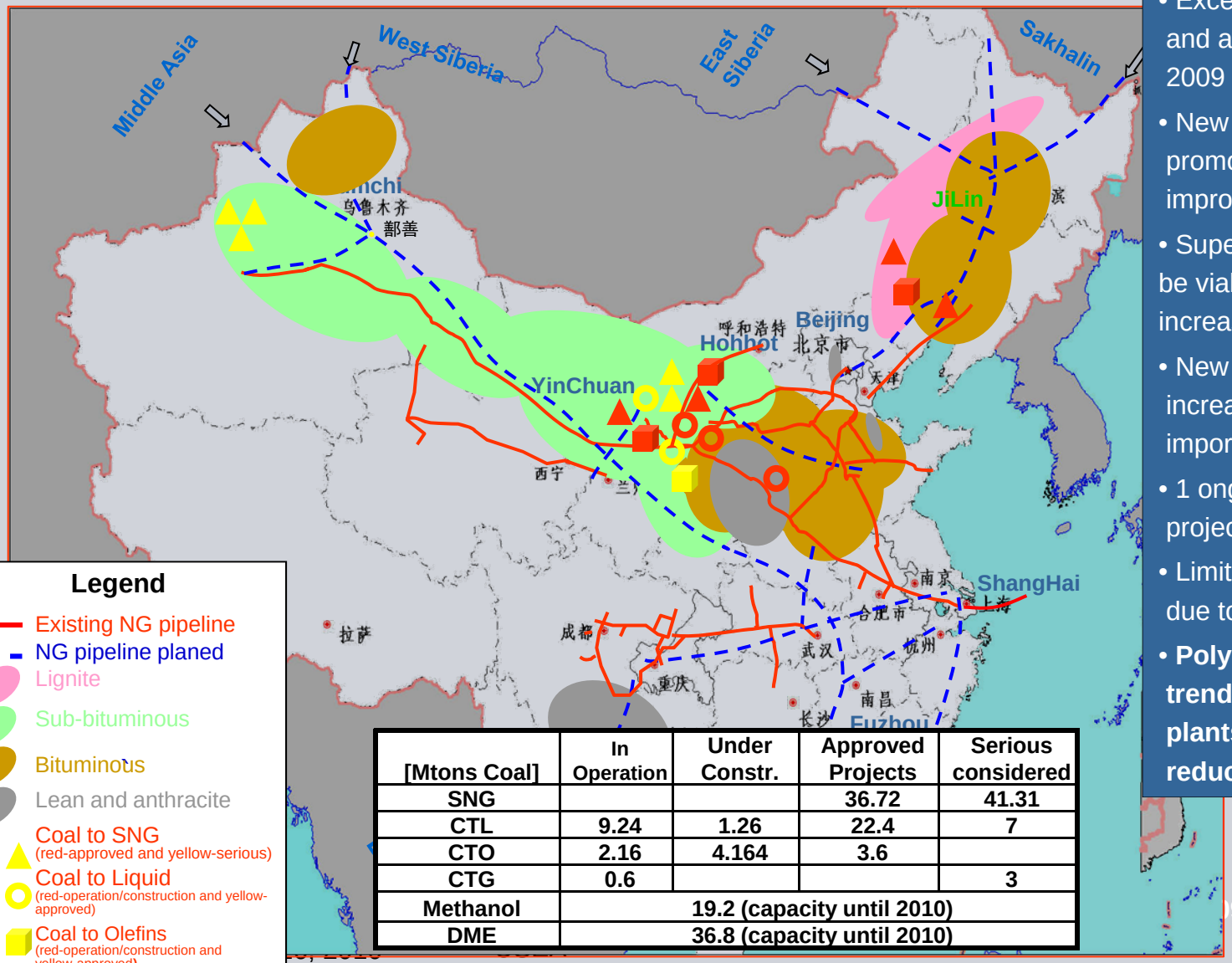
AUSTRALIA

- Successful implementation depends on CO_2 legislation
- 2 governmental funded IGCC projects
- Large CTL and fertilizer projects under development

Limited by Delayed Climate Legislation and Reduced Access to Debt and Equity for Large Capital Projects

But: Increasing fuel prices (crude oil), security of supply and beginning recovery of economy starts driving new gasification projects primarily in Asia

Coal Gasification Potential in China



Legend

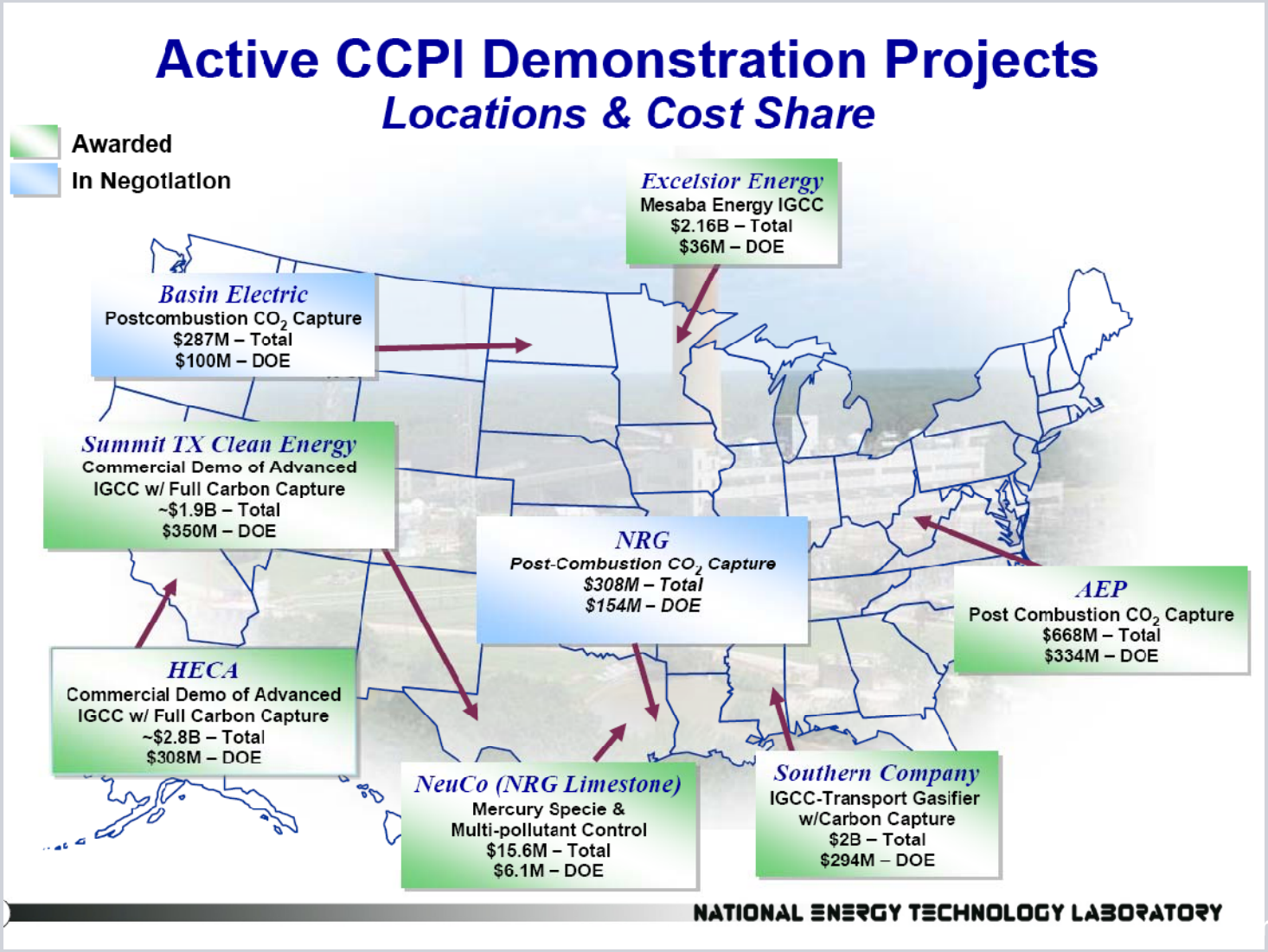
- Existing NG pipeline
- NG pipeline planed
- Lignite
- Sub-bituminous
- Bituminous
- Lean and anthracite
- Coal to SNG (red-approved and yellow-serious)
- Coal to Liquid (red-operation/construction and yellow-approved)
- Coal to Olefins (red-operation/construction and yellow-approved)

[Mtons Coal]	In Operation	Under Constr.	Approved Projects	Serious considered
SNG			36.72	41.31
CTL	9.24	1.26	22.4	7
CTO	2.16	4.164	3.6	
CTG	0.6			3
Methanol	19.2 (capacity until 2010)			
DME	36.8 (capacity until 2010)			

Market Trend and Conclusion

- Excessive coal to methanol and ammonia production in 2009
- New government policy promotes mega scale to improve competitiveness
- Super scale Coal to SNG will be viable as natural gas prices increase
- New CTO and MTO extension increasing due to 40% shortage imported
- 1 ongoing CTL demonstration project driven by government
- Limited IGCC demonstrations due to high investment
- **Poly-generation might be a trend due to mega chemical plants and need for CO2 reduction**

US Clean Coal Demonstration Projects



Siemens Gasifier Activity Landscape

Capital Power
270 MW_e IGCC

Calgary

Secure Energy
1000 MW_{th}

Orlando

Summit Power, TCE
400 MWe IGCC +
Ammonia, 1000 MW_{th}

Tenaska
Coal to SNG/Power
1000 MW_{th}

Sustec, Schwarze Pumpe
200 MW_{th}, 1984 - 2007

Confidential Client
Coal to SNG

HQ Freiberg
Test Facility

Vresova
175 MW_{th}, IGCC
Liquid feedstock
COD 2008

NCPP I
Coal to
Polypropylene
2500 MW_{th}

China JV
GSP China

JinCheng
Coal to Ammonia
1000 MW_{th}

Confidential Client
Coal to Liquids

AEC
Coal to UREA

Siemens Offices
Operating Units
Current Projects
Technology Selected

9 SFG-500 Gasifiers (incl. other key equipment) shipped
Technology selected and pre-selected for additional projects

NCPP I: Largest Coal to Chemical Plant in China

5 x SFG-500 class gasifier: Coal to Polypropylene plant

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Siemens Scope:

- Engineering
- Equipment Supply
  - Gasifiers, Burners, Feeder Vessels, ...
- Training (Freiberg Simulator)
- Technical Field Assistance

Feedstock:

- Subbituminous Coal
- Ash: ~ 7 wt%
- Moisture: ~ 2 wt%

Status

- Engineering Completed
- All Gasifiers shipped and erected
- Piping installation in progress
- Start up Year: 2010

Power Station

Air Separation Units

Methanol to Polypropylene

Black Water Treatment

Tenaska, Inc.
Taylorville Energy Center

SIEMENS

Location / Fuel: Taylorville, IL
Illinois coal #6

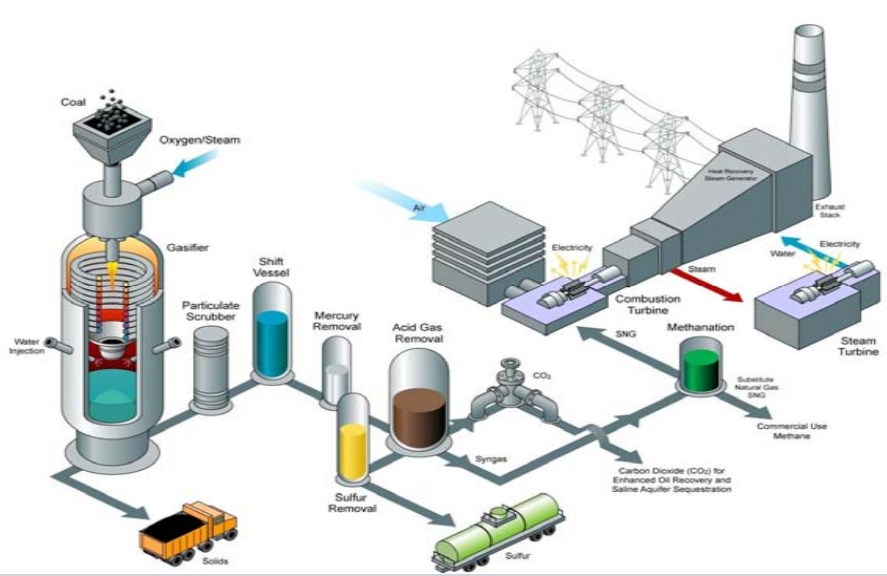
Power output: 500 MW (net)

Siemens scope: 2 x SFG-500 Gasifier and
2 x SGT6-5000F

CCS capture rate: > 50% used for EOR

Time schedule: ICC Decision 2010
Operation total plant: 2015

DOE support: $ 2.5 B loan guarantee



Hybrid IGCC with intermediate SNG production and standard natural gas fired Gas Turbine

Summit Power Group
Texas Clean Energy Project

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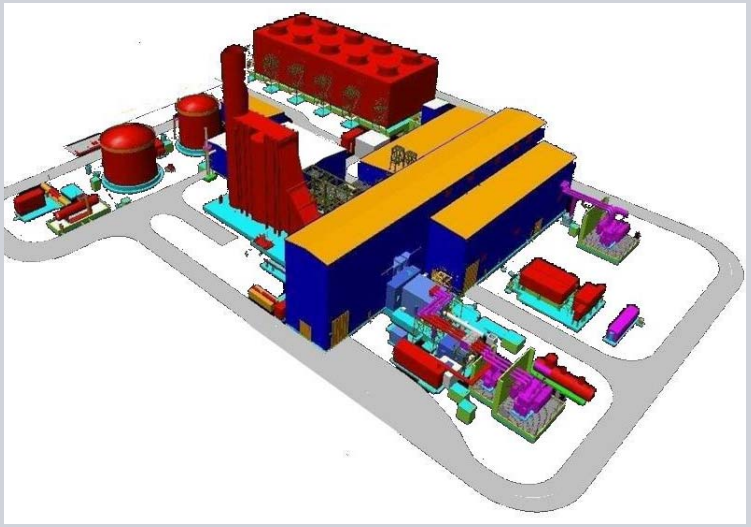
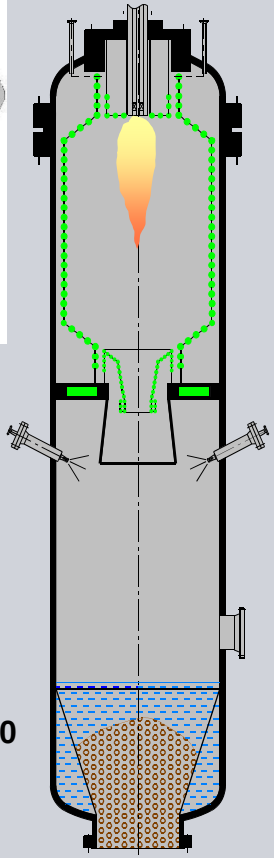
- Largest CCPI Award to Date
- 400 MW_e "Polygen" IGCC project
- 90% carbon capture (2.7M tons of CO_2/year; CO_2 emissions only 20 to 30% of a natural gas combined cycle)
- Siemens to supply
  - SFG-500 gasifiers
  - SGCC6-5000F 1x1 operating on high H_2 syngas
  - Plant Operation and Maintenance services
- Located at FutureGen "finalist" site directly atop Permian Basin and CO_2/EOR opportunities



Siemens SGCC6-5000F 1x1 Power Block



Siemens SFG-500 Gasifier

Siemens Gasification Technology
Siemens Gasification Island Battery Limits

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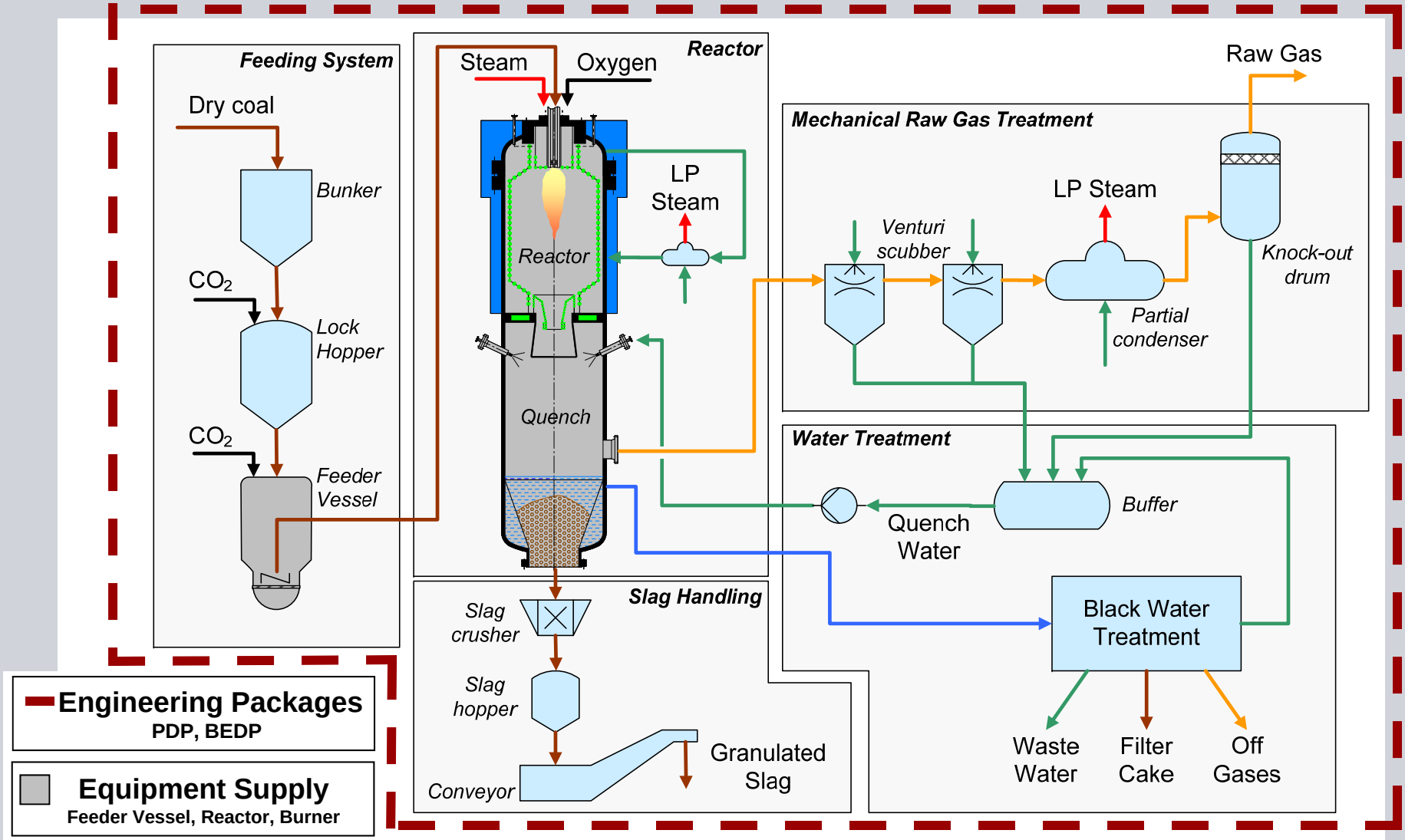

Siemens Fuel Gasification Technology: Cooling screen reactor

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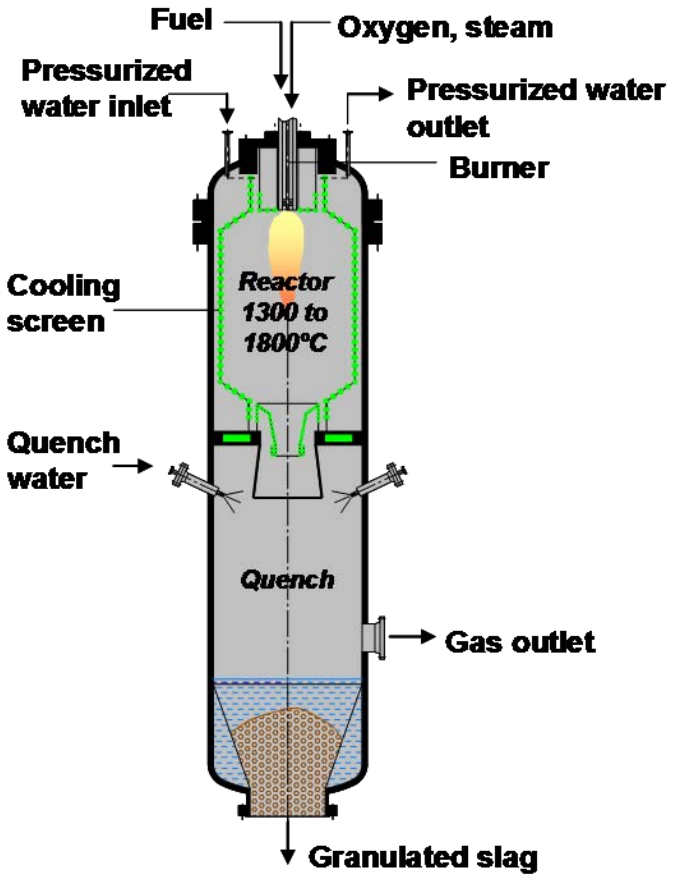
SFG Gasifier (> 2% ash)



Features

Fuel flexibility

- Lignite, bituminous & sub-bituminous coal, hard coal, pet-coke (w/o flux), biomass

Dry feeding

- high efficiency (>80%),
- high carbon conversion rate (> 98%)

Cooling screen

- short start-up / shut-down (~ 2h)
- high lifetime and high availability

Full quench

- simple and reliable
- ideal for CO sour shift

Single main burner with integral pilot burner

- Eliminates the need to disassemble start-up burner(s)
- Facilitates maintenance (downtime for burner change one day)

Advanced Controls

- increased availability

Siemens Fuel Gasification Technology
Verified Performance with Different Feedstocks

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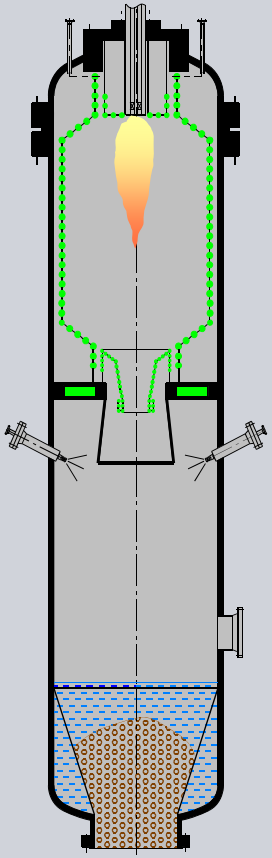
- Anthracite
- Bituminous coals
- Sub-bit. coals
- Lignite
- Petcoke
- Tar oils
- Biomass



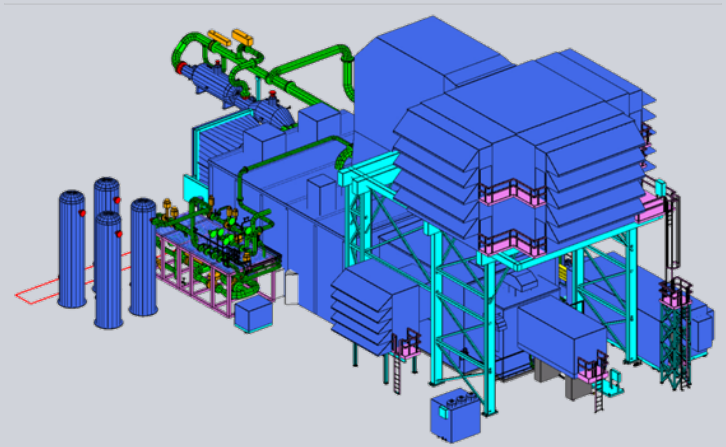
Siemens Gasification Test Facility

More than 100 gasification tests performed with more than 60 different feedstocks including coals from Australia, Germany, Canada, South Africa, China,…

IGCC Power Island Solutions

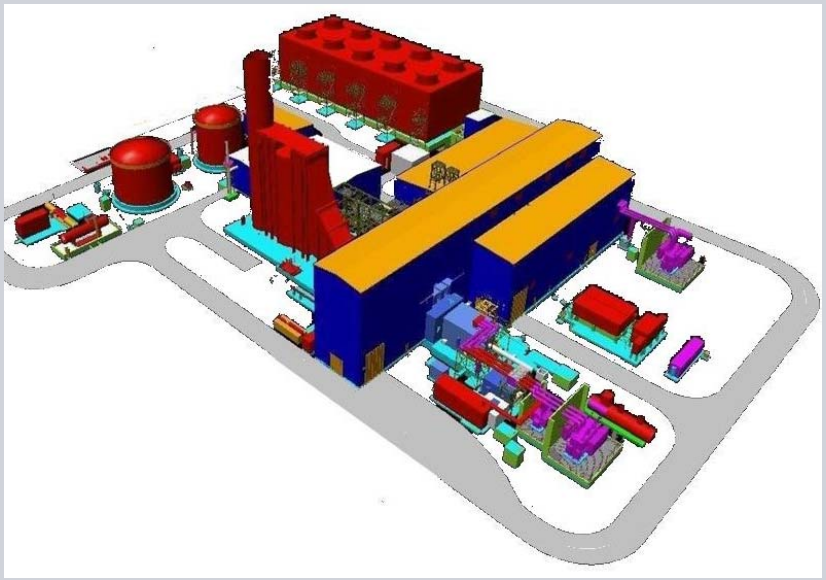
SGT6-PAC 5000F

- 232 MWe GT-G for low-BTU fuel applications (ISO conditions)
- 15 ppm NO_x
- Can be integrated with wide range of gasifiers operating with a broad range of feedstocks



SGCC6-5000F 1X1 and 2X1

- 300-400 and 630 MWe power block concepts
- Based on standard SCC6-5000F 1X1 and 2X1



Four IGCC Project Pre-FEEDs Completed, One FEED in progress

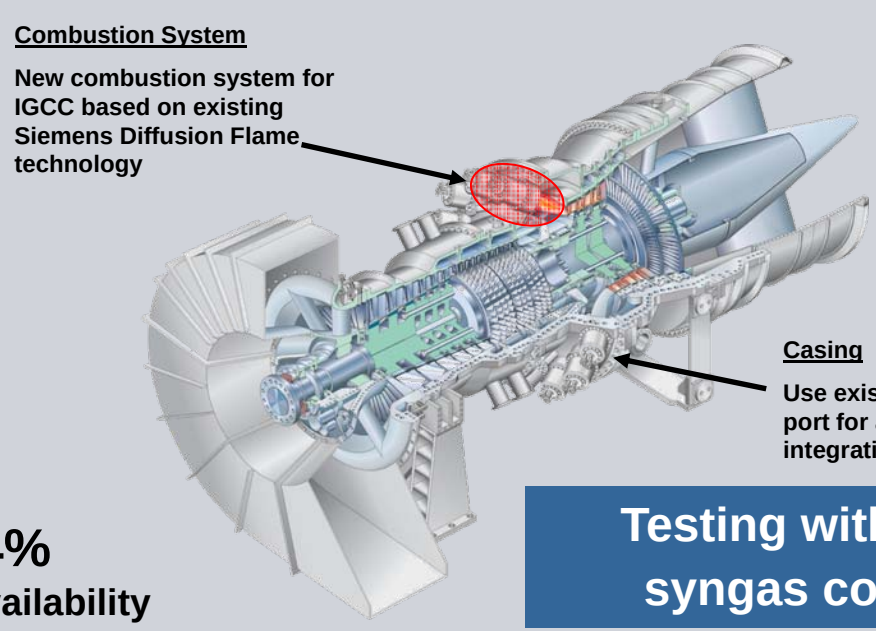
Today's Fuel Flexible SGT6-5000F

SGT6-5000F for IGCC Applications

- Based on proven standard product and fleet experience
- Lessons learned from over 650,000 hours of prior and current IGCC plants experience
- Full scale testing forms the basis for new technology improvements

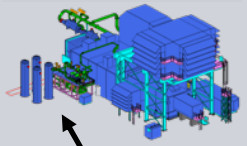
Siemens IGCC Experience Base

Full Scale Test Facilities



Combustion System

New combustion system for IGCC based on existing Siemens Diffusion Flame technology



Auxiliary Systems

Fuel handling auxiliaries and engine control system modified for IGCC application

Casing

Use existing access port for air extraction / integration purposes

94%
Fleet Availability
229 Units in Operation

Testing with high H2 syngas completed

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Conclusions

- **Near term global demand for gasification based solutions is focused on projects that produce high value products and can address climate change now**
  - Near Term: Using EOR for CO_2 storage
  - Longer Term: Price signal for carbon is necessary
- **Economic hurdles still exist for gasification based projects that the next wave of projects will address**
  - Government financial support for commercial scale demonstration projects will help accelerate deployment
- **Longer term energy megatrends will drive demand for gasification based solutions for power, chemicals and clean transportation liquids**

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Questions ?

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