

Cleanly Unlocking the Value of Low Rank Coal

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SYNTHESIS ENERGY SYSTEMS

Coal is Here to Stay



EIA 2010 Outlook from 2007 to 2035

Coal Consumption  56%

Energy Consumption due to Coal  27%

Figure 2. World marketed energy use by fuel type

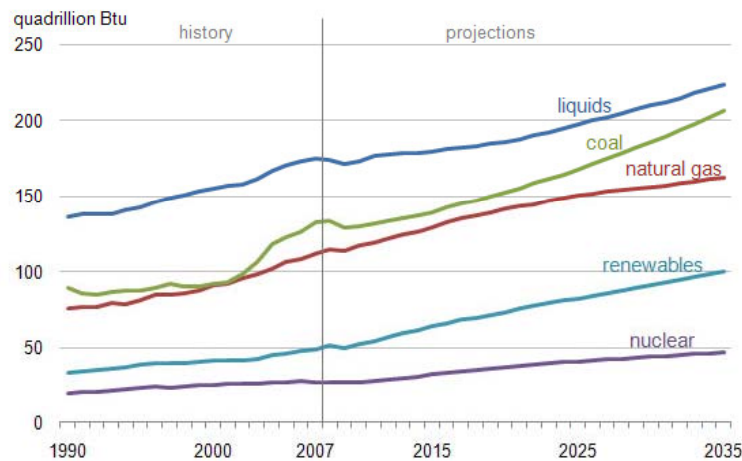
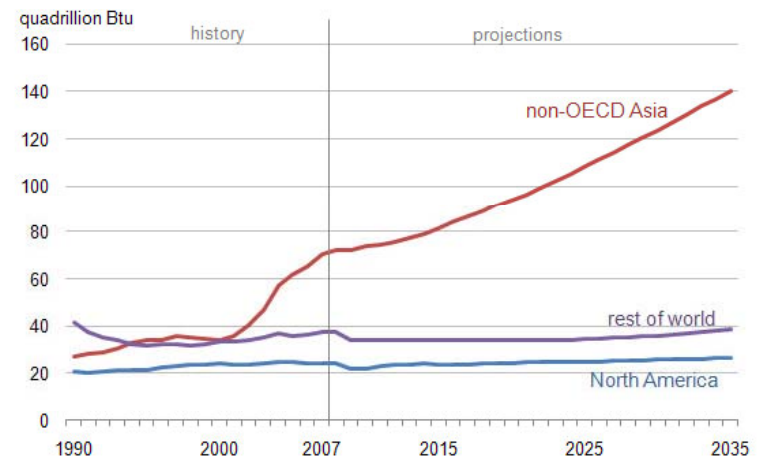


Figure 5. World coal consumption by region



Coal Consumption In China/India  87%

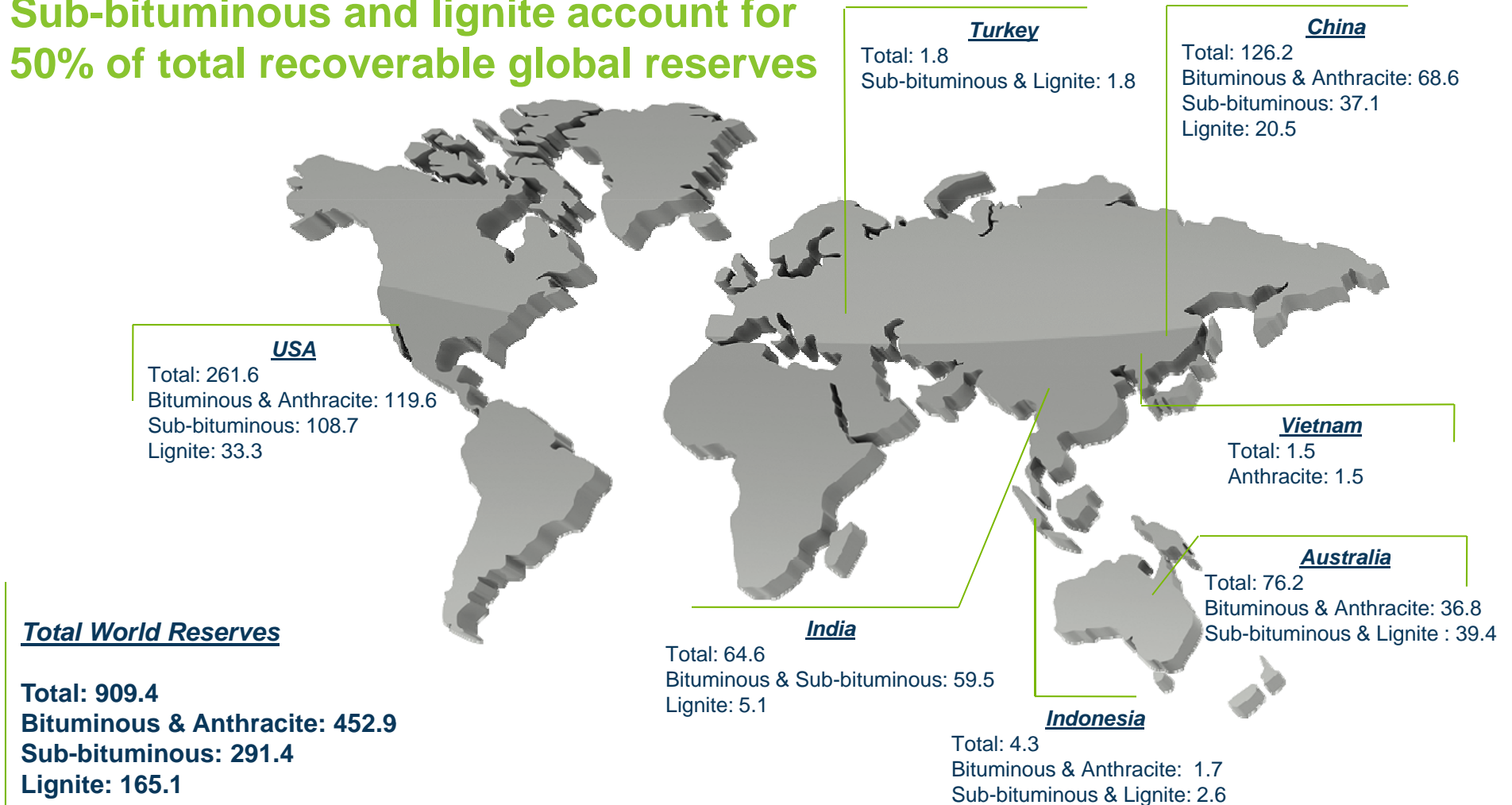
China Coal Imports 2008 to 2009  100%

Sources: EIA International Energy Outlook 2010

World Coal Reserves in Billion Short Tons

Sources: EIA International Energy Outlook 2010, BP Statistical Review of World Energy 2010, * Recoverable Reserves per EIA

Sub-bituminous and lignite account for 50% of total recoverable global reserves

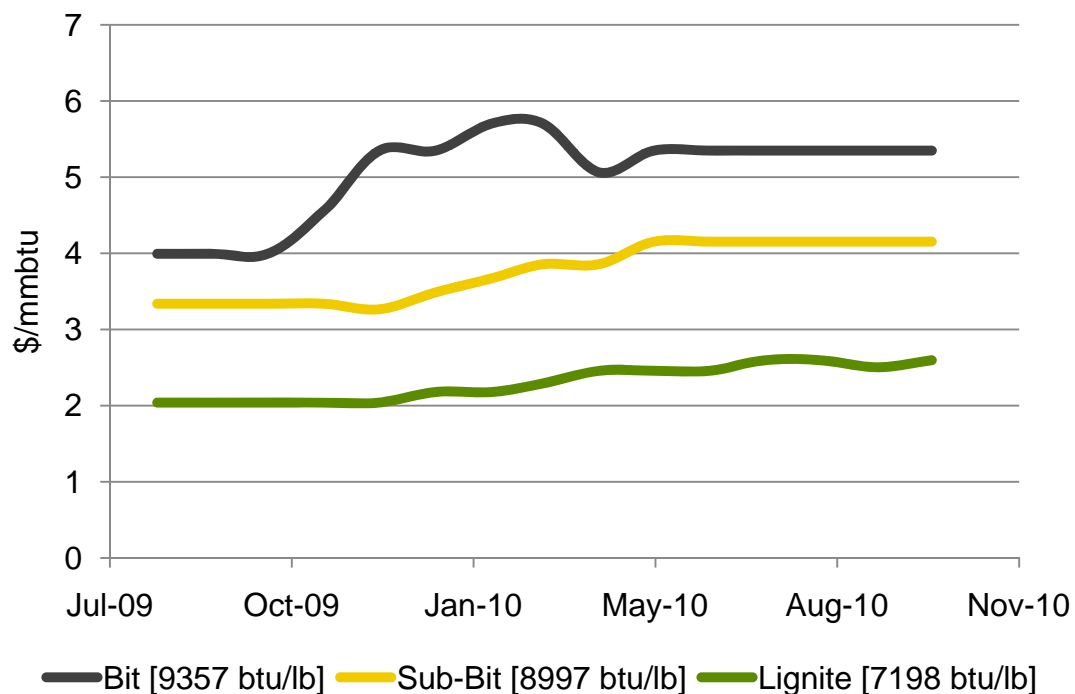


An Evident Disparity



Value Entitlement of Low Quality Coal

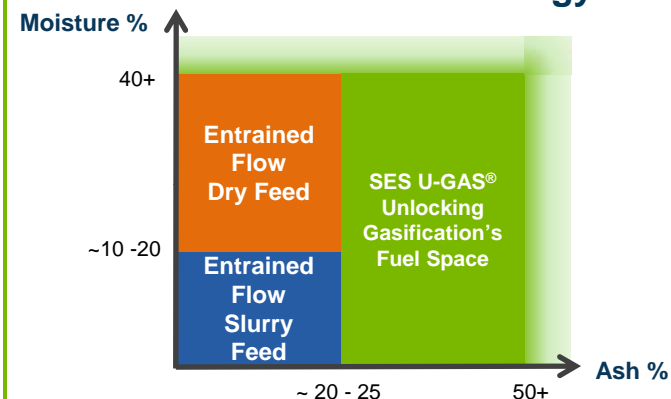
China Coal Price Spread



SES' U-GAS® successfully tested on less expensive, lower quality fuels



Fuel Envelope by Gasification Technology



U-GAS® Fuel Flexibility	Tested Range
Moisture Content, wt %	1 – 41
Volatile Matter, wt %	3 – 69
Fixed Carbon, wt %	6 – 83
Sulfur, wt %	0.2 – 4.6
Free Swelling Index	0 – 8
Ash Content, wt %	<1 – 55%
Ash Softening – T ₁ , °F	1,900 – 2,500
Heating Value, HHV, Btu/lb	5,500 – 14,000

Decades of Defining Fuel Flexibility



Sub-bit Coal & Lignite

Chinese, Shen Fu – Sub-Bituminous
 Henan Yima – Sub-bituminous
 Indian, Dadri, ROM
 Montana Rosebud, Colstrip – Sub-bituminous
 Wyoming, Big Horn – Sub-bituminous
 North Dakota Lignite, Freedom
 Saskatchewan Lignite, Shand
 Inner Mongolia Lignite Baiyinghua

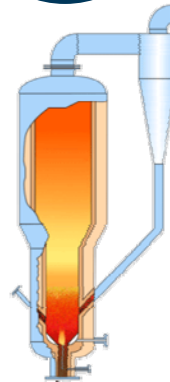
Bituminous Coal

Western Kentucky #9, washed & ROM
 Western Kentucky #9 and 11, Camp
 Australian, Bayswater #2, Sydney Basin
 Pittsburgh #8, Champion and Ireland
 Illinois #6, Peabody #10 & Crown III
 Polish, Silesia
 French, Merlebach – ROM
 Utah – ROM
 Columbian
 Indian, N. Karanpura, washed & ROM
 Shandong – ROM & washing middlings

Lignite

Sub-bituminous & Bituminous

Coal Biomass Blend



Biomass

Biomass

Pelletized waste wood, wood chips
 Bagasse
 Whole tree chips, hard and soft woods
 Danish Willow
 Rice and wheat straw
 Alfalfa stems
 Highway clippings
 Bark and pulp sludge
 Chicken litter

Coke Char, Peat & Wastes

U.S., China, Poland, Metallurgical Coke
 Western Kentucky No. 9 coal char
 Illinois No. 6 coal char
 Finnish Peat, Viidansuo and Savaloneva
 US Peat, Minnesota and North Carolina
 Oil Shale, Eastern US
 Automobile Shredder Residue

SES' Zao Zhuang Plant - Proving Fuel Flexibility



- Designed for coal washing wastes (middlings) - 40%wt ash coal
- Continually demonstrating U-GAS® fuel flexibility, including successful commercial operations on:
 - ROM bituminous coal
 - Coal washing waste (middlings) - up to 55%wt ash
 - High-ash sub-bituminous coal
 - High moisture & high ash lignite
- Consumption on design coal
 - Coal to clean syngas ~1.0 Nm³/kg
 - O₂ to clean syngas ~0.27 Nm³/Nm³
 - Steam to clean syngas ~0.40 kg/Nm³
- Turndown to 30% of design syngas rate
- 94% availability to meet customer's syngas needs



Location	Zao Zhuang City, Shandong Province
Partner	Shandong Hai Hua Coal & Chemical Co. Ltd.
Design Fuel	40%wt ash coal middlings
Design Capacity	22,000 Nm³/hr (2 X 400 mtpd gasifiers)
Cold Gas Efficiency	Up to 82%
Carbon Conversion	88-99%

Inner Mongolia Lignite Test (2009)



	Coal Proximate Analysis
Moisture Content, wt % (ad)	12.05
Ash Content, wt % (ad)	20.40
Volatile Matter, wt % (ad)	31.18
Fixed Carbon, wt % (ad)	36.37
Moisture Content, wt% AR	26.50
LHV, BTU/lb, AR	6,786

	Syngas*
CO+H ₂ , mol%	65.14
H ₂ /CO Ratio	1.43
HHV, BTU/scf	254

* On a nitrogen, sulfur and moisture free basis

79%
CGE

96%
**Carbon
Conversion**

Process Enhancement Test (2010)



	Coal Proximate Analysis
Moisture Content, wt % (ad)	1.84
Ash Content, wt % (ad)	27.39
Volatile Matter, wt % (ad)	29.64
Fixed Carbon, wt % (ad)	41.13
Moisture Content, wt% AR	4.0
LHV, BTU/lb, AR	9,162

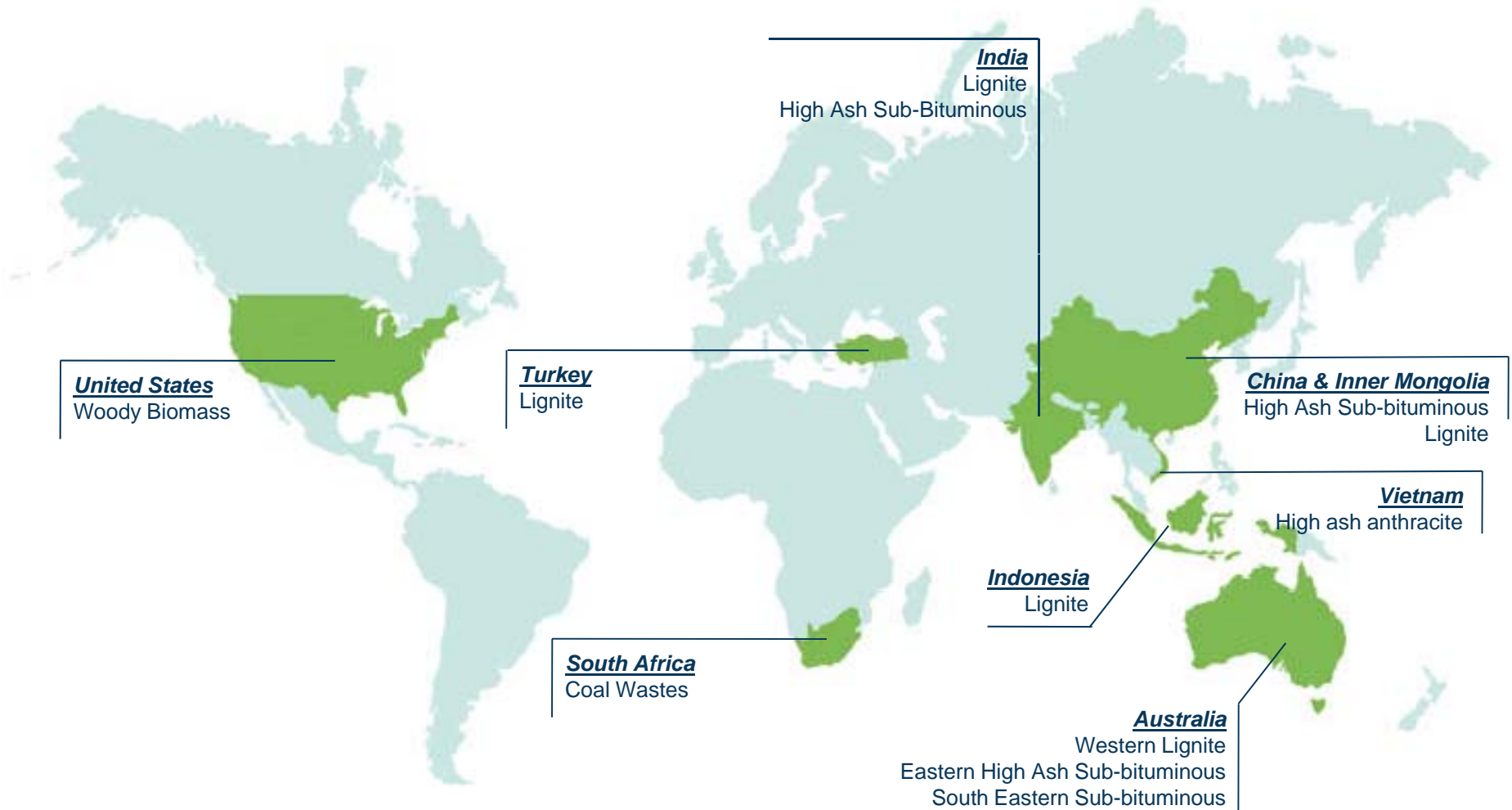
	Syngas*
CO+H ₂ , mol%	66.60
H ₂ /CO Ratio	1.23
HHV, BTU/scf	256

* On a nitrogen, sulfur and moisture free basis

82%
CGE

>99%
Carbon
Conversion

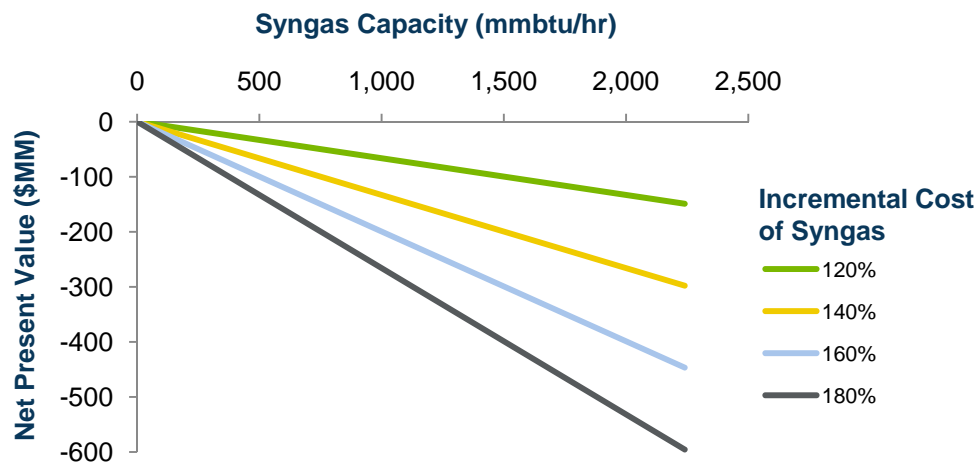
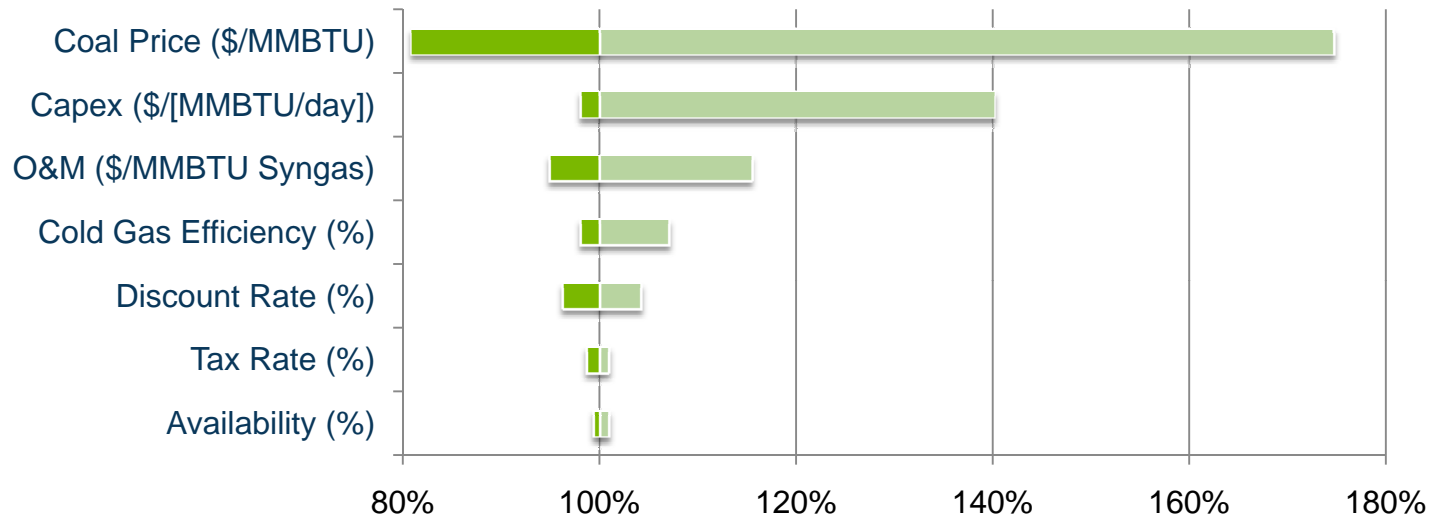
2010/11 Testing at GTI & Zao Zhuang Facility



Fuel Quality Impact on Project Economics



Key parameters Impacting Cost of Syngas



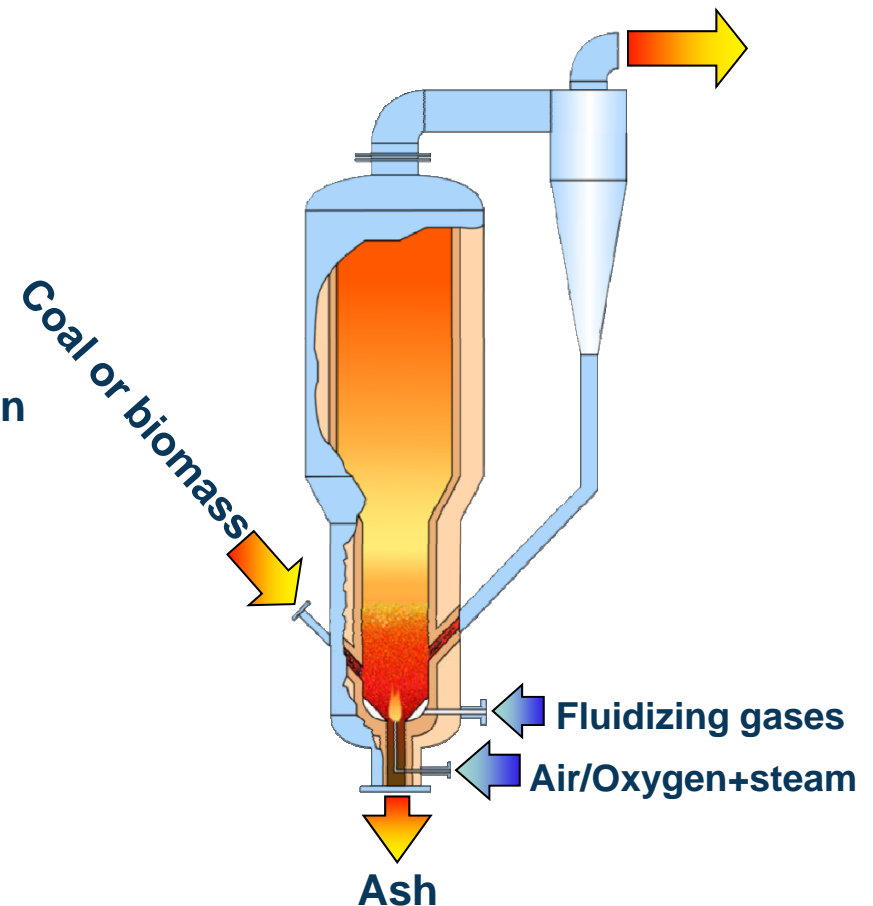
Key parameters a licensee can control when selecting gasification technology:

- Fuel price
- Capex
- Efficiency
- Availability

SES' Gasification – A Flexible Solution



- Proven capability to gasify a wide variety of fuels, including high ash and low rank coals and biomass
- High carbon conversion, >95%
- Simple design with safe, reliable operation
- Turndown to 30% of syngas design capacity
- No tars and oils generated for coal gasification
- Flexible design: air-blown, enriched-air or oxygen-blown operation
- Bubbling bed = good mixing for even temperature control
- Long residence times = high conversion & high tolerance to fuel switching and fluctuations
- Capable of gasifying fine particles
- Moderate temperatures results in low cost & high availability



In Summary



Synthesis Energy Systems

- is focused on projects based on lignite and sub-bit coals
- is focused on carrying its technology solution into growth areas of the world that are demanding economic uses for their local energy sources
- has a three-tiered strategy for participation in projects
 - *Licensing through technology transfer and equipment supply*
 - *BOO/BOT in strategic projects*
 - *Partnering globally in projects that integrate into under-utilized coal resources*