

# Cleanly Unlocking the Value of Low Rank Coal

Fawad Khan, Technology Manager

2010 Pakistan Coal Forum  
Houston, Texas  
November 18, 2010



SYNTHESIS ENERGY SYSTEMS

# Forward Looking Statements



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# Introduction to Synthesis Energy Systems

# SES – A Global Energy & Gasification Technology Provider



**Publicly listed energy gasification technology company headquartered in Houston, Texas**

- Exclusive global license to U-GAS® gasification technology from the Gas Technology Institute® (GTI®)
- U-GAS® is a commercially proven technology capable of cleanly converting low grade coals and biomass into high value energy products

**Company launched in China, the fastest growing and most active market for gasification**

- First project - 2 years of operation history in Zao Zhuang City, Shandong Province, China. Second project under construction in Yima City, Henan Province, China
- Expanding into other high energy consumption growth regions with abundance of coal and biomass

**Organizational Capability - Project Development and Management, Technology and Plant Operations**

- U-GAS® technology experts from SES and GTI
- Engineering and technology expertise in China
- Strong operating team with growing knowledge base of plant operations



**SYMX**  
**NASDAQ®**  
**LISTED**

# World Energy Outlook



## 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

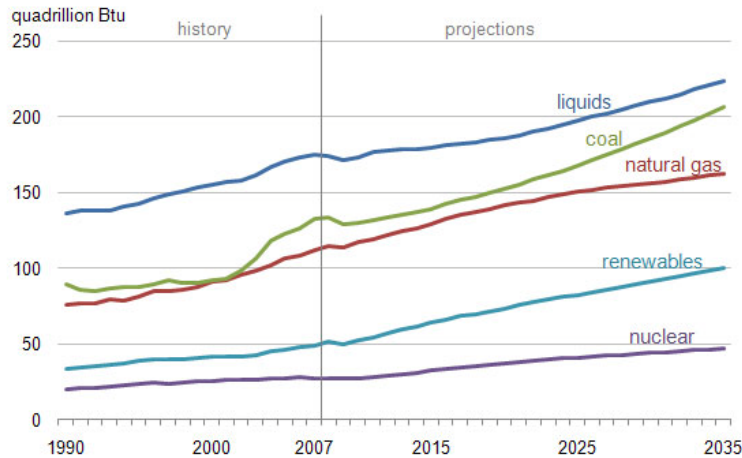
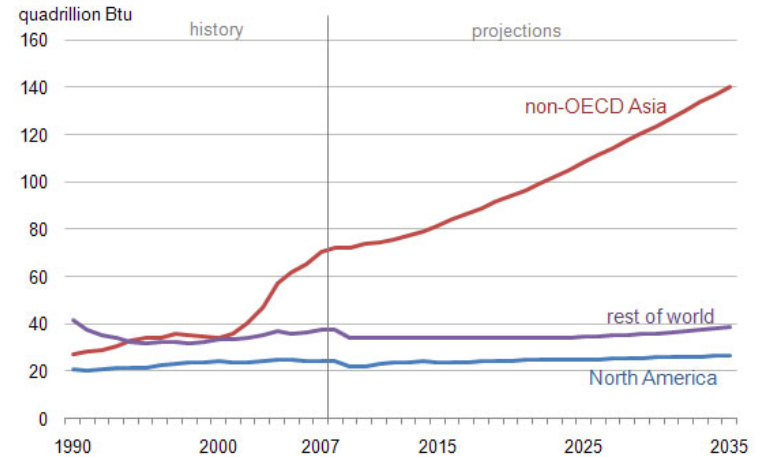


Figure 5. World coal consumption by region



China/India coal consumption



87%

China coal imports 2008 to 2009

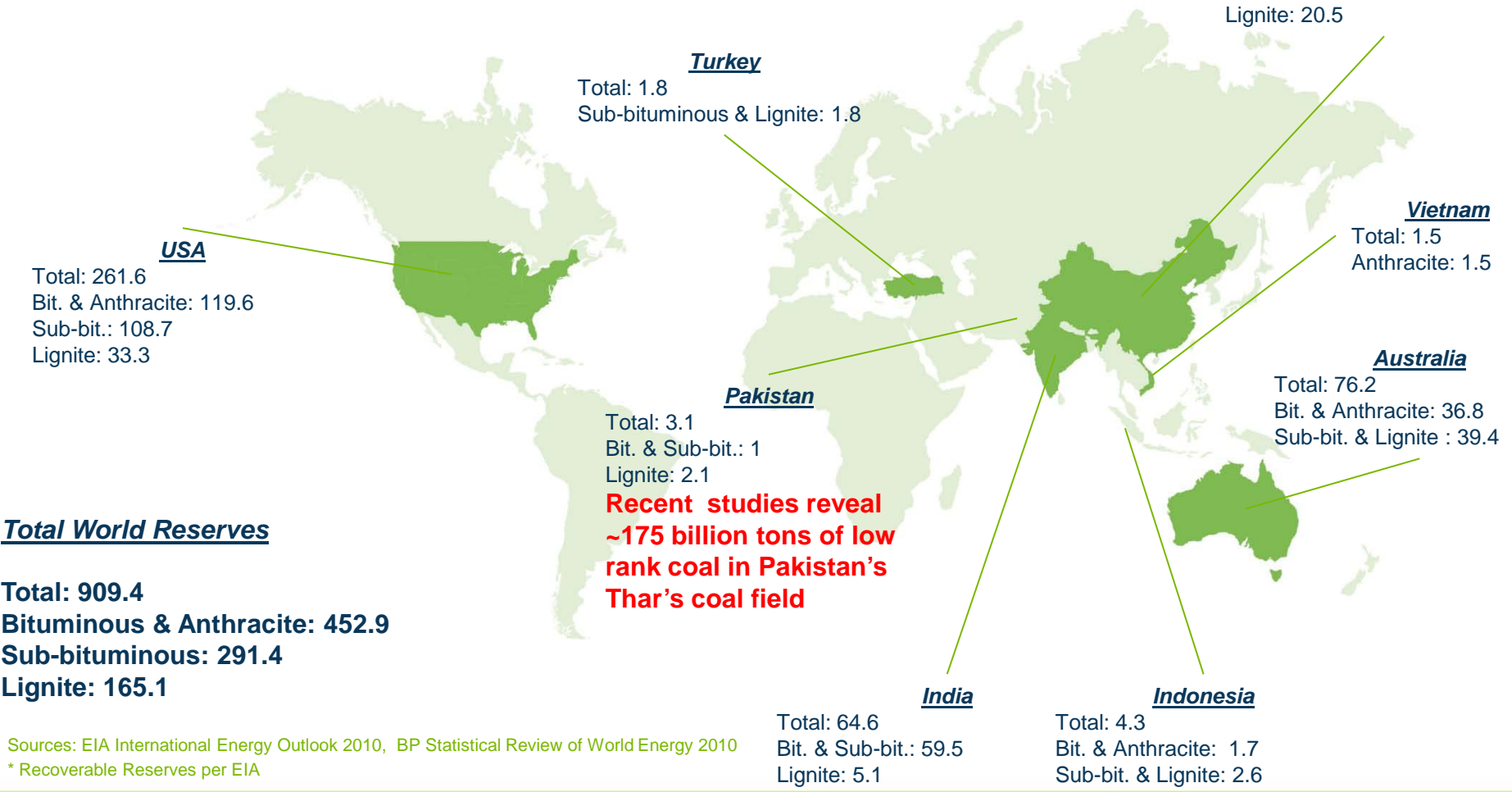


100%

Sources: EIA International Energy Outlook 2010

# World Coal Reserves in Billion Short Tons

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



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

# The True Value of Low Rank Coals

## Low Value Feedstocks

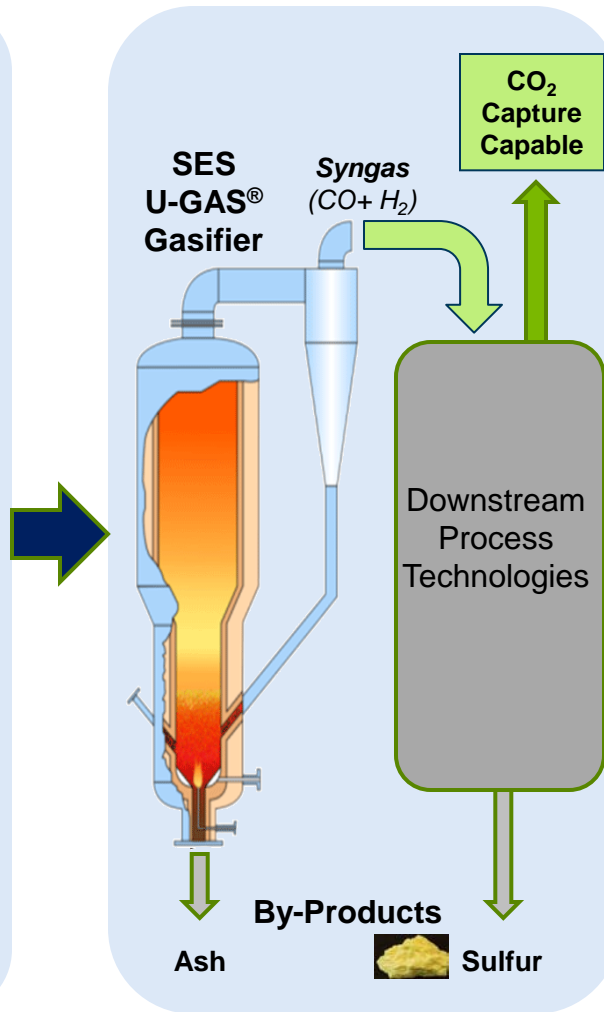
### Low rank coals



### Biomass



## Process



## End Products

### Fuels



- Gasoline blending
- Syngas to gasoline
- Diesel - DME & FT liquids
- LPG - DME blending

### Fertilizers



- Ammonia
- Urea

### Chemicals



- Methanol
- Hydrogen
- Olefins
- Acetic Acid
- Glycol

### Steel Making



- DRI

### Gas



- Synthetic natural gas (SNG)
- Fuel Gas

### Power



- IGCC
- Fuel cells



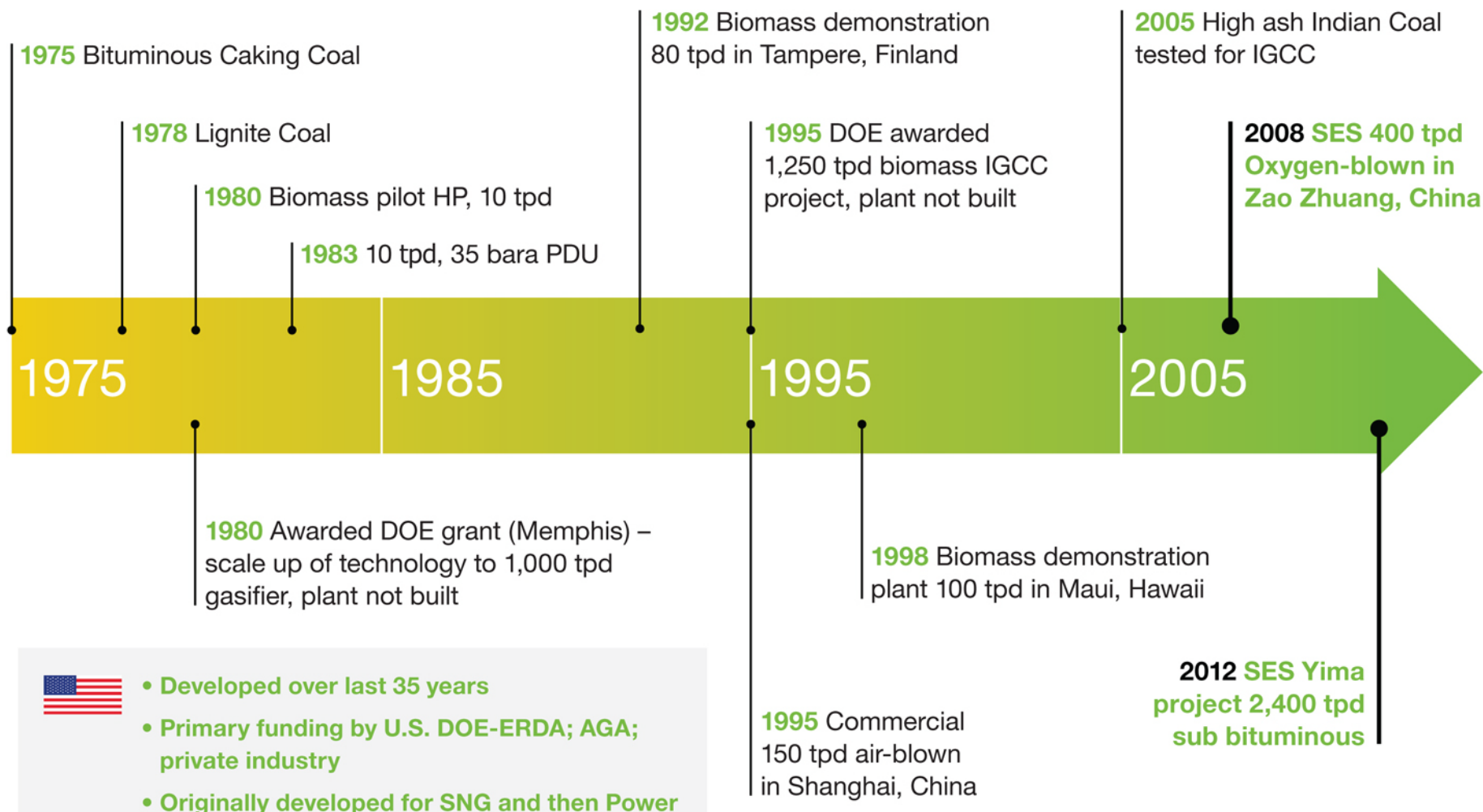
SYNTHESIS ENERGY SYSTEMS

CLEANLY UNLOCKING THE VALUE OF COAL




# SES' U-GAS<sup>®</sup> Technology

# Development of SES's U-GAS<sup>®</sup>



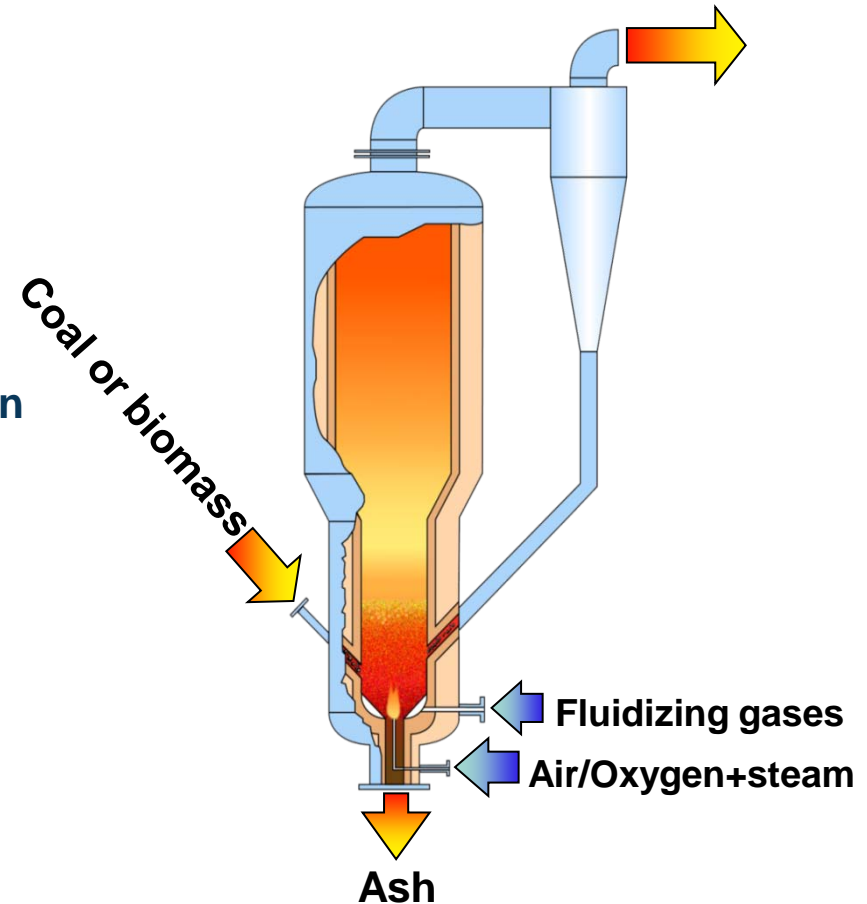
- Developed over last 35 years
- Primary funding by U.S. DOE-ERDA; AGA; private industry
- Originally developed for SNG and then Power

# Gasification Platforms

Characteristic	Fluidized Bed	Entrained Flow	Fixed/Moving Bed
<ul style="list-style-type: none"><li>• Fuel Type</li><li>• Fuel Size</li><li>• Residence Times</li><li>• Oxidant</li><li>• Gasification Temp</li><li>• Ash Handling</li></ul>	 <ul style="list-style-type: none"><li>• Dry solids</li><li>• 0.05 – 6 mm</li><li>• minutes</li><li>• Air or Oxygen</li><li>• 840 - 1,100°C</li><li>• Non-slagging</li></ul>	<ul style="list-style-type: none"><li>• Dry Solids or Liquids</li><li>• &lt;500 microns</li><li>• 1 – 10 sec</li><li>• Air or Oxygen</li><li>• 1,800°C</li><li>• Slagging, with or without quench</li></ul>	<ul style="list-style-type: none"><li>• Dry Solids</li><li>• 8 - 50 mm</li><li>• hours</li><li>• Air or Oxygen</li><li>• 450 - 650°C</li><li>• Slagging or non-slagging</li></ul>

# 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
- Good mixing for even temperature control
- Long solids residence times for high conversion
- Long gas residence times easily tolerant to fuel switching and fluctuations
- Capable of gasifying fine particles
- Moderate temperatures results in low cost & high availability



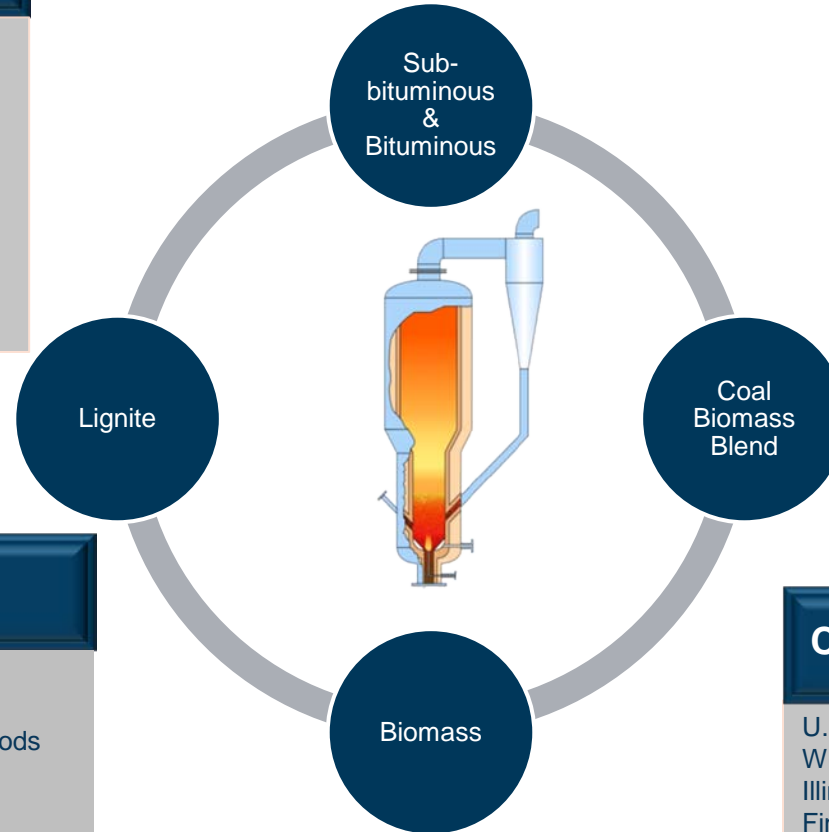
# Decades of Defining Fuel Flexibility

## 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



## 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

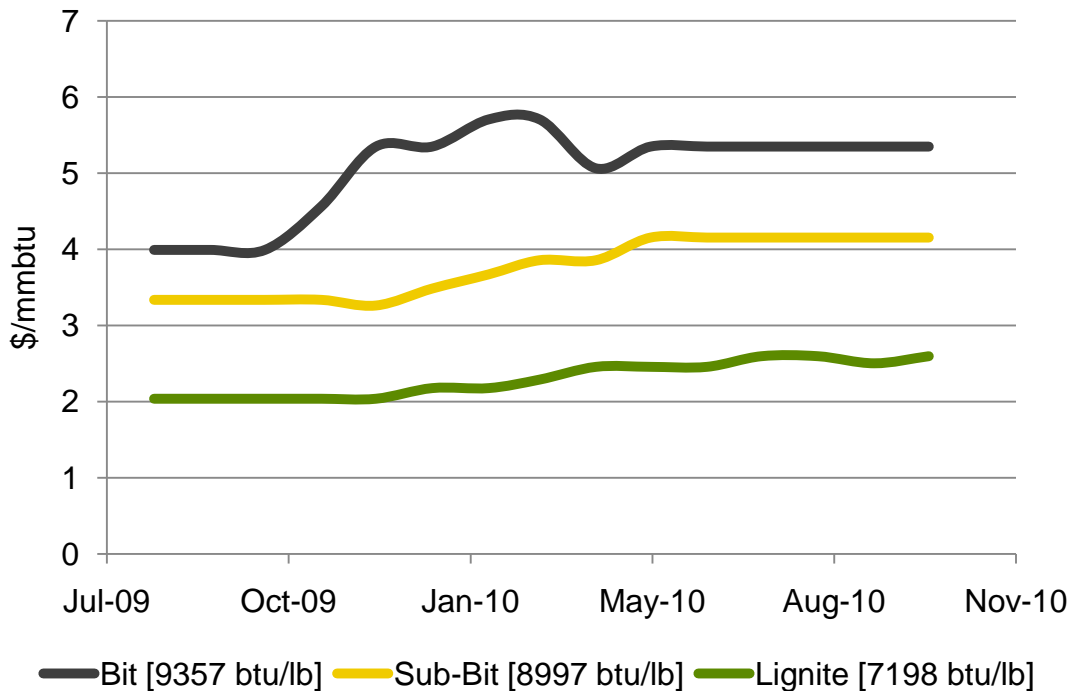
## Coke Char, Peat & Wastes

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

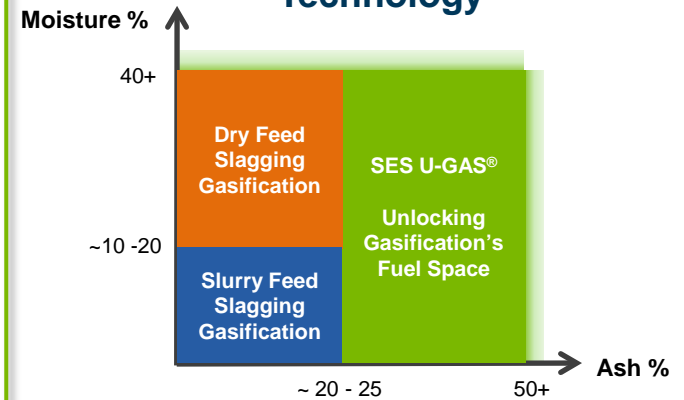
# An Evident Fuel Disparity

## U-GAS® - Capturing Value Entitlement from Low Quality Coal

### China Coal Prices Spreads



### Fuel Envelope by Gasification Technology



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 <sub>1</sub> , °F	1,900 – 2,500
Heating Value, HHV, Btu/lb	5,500 – 14,000

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



# 2009 Lignite Test



	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*
H <sub>2</sub> /CO Ratio	1.43
HHV, BTU/scf	254

**79%**  
**CGE**

**96%**  
**Carbon  
Conversion**

\* On a nitrogen, sulfur and moisture free basis

# 2010 Process Enhancement Test



	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*
H <sub>2</sub> /CO Ratio	1.23
HHV, BTU/scf	256

81.7%  
CGE

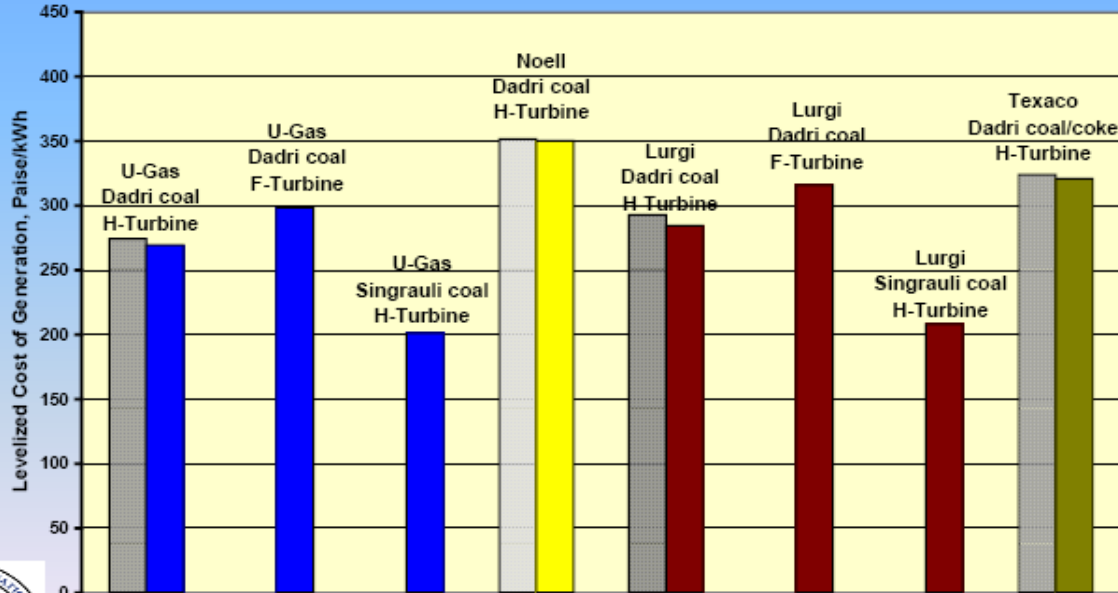
>99%  
Carbon  
Conversion

\* On a nitrogen, sulfur and moisture free basis

# A Third Party Report

## IGCC Technology Comparison

Comparison of Levelized Cost of Generation  
(25 y plant life, 7,000h/y operation)  
(solid bars: ROM coal; shaded bars: washed coal)



Note: US Cost

Coal Analysis			
Proximate Analysis	Dadri Raw Coal	Dadri Washed Coal	Singrauh Raw Coal
Moisture	8.69%	7.44%	9.82%
Ash	38.22%	32.97%	26.33%
Volatile Matter	23.76%	26.71%	28.51%
Fixed Carbon	29.33%	32.88%	35.34%
Total	100.00%	100.00%	100.00%
Ultimate Analysis			
Moisture	8.69%	7.44%	9.82%
Carbon	40.30%	45.99%	50.22%
Hydrogen	3.19%	3.58%	3.69%
Nitrogen	0.90%	1.00%	1.09%
Sulfur	0.50%	0.45%	0.33%
Ash	38.22%	32.97%	26.33%
Oxygen	8.20%	8.57%	8.52%
Total	100.00%	100.00%	100.00%





# SES' Commercial Plants

# SES' Zao Zhuang Plant - Proving Fuel Flexibility



- Designed for coal washing wastes (middlings) 40%wt ash coal
- Demonstrated 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 kg/Nm<sup>3</sup>
  - O<sub>2</sub> to clean syngas ~0.27 Nm<sup>3</sup>/Nm<sup>3</sup>
  - Steam to clean syngas ~0.40 kg/Nm<sup>3</sup>
- Turndown to 30% of design syngas rate
- 98%+ availability to meet customer's syngas needs



<b>Location</b>	Zao Zhuang City, Shandong Province
<b>Partner</b>	Shandong Hai Hua Coal & Chemical Co. Ltd.
<b>Design Fuel</b>	40%wt ash coal middlings
<b>Design Capacity</b>	400 tpd (1 operating & 1 spare)
<b>Cold Gas Efficiency</b>	Up to 82%
<b>Carbon Conversion</b>	88-99%

# SES' Yima Multi-Phase Project



- The Yima Coal Industry Group is one of China's 10 largest integrated coal companies with total assets of RMB 15.7 billion (USD \$2.3 billion)
- Yima owns and operates a large Lurgi gasification plant for town gas and methanol production
- Chosen SES U-GAS® for its expansion projects because of U-GAS® efficiencies after running Yima's high-ash sub-bituminous coal at SES' Zao Zhuang facility for approximately 2 weeks in November 2008
- Yima and SES in discussion regarding expanding project – 2X size of Phase 1



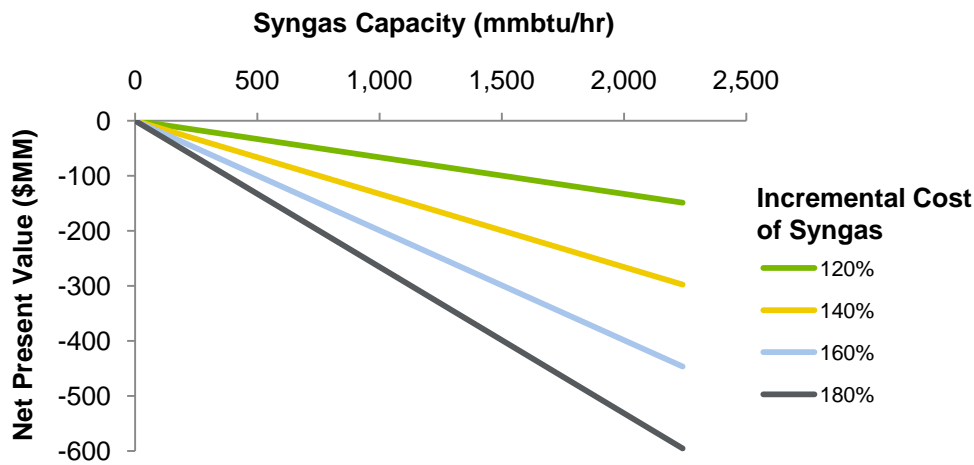
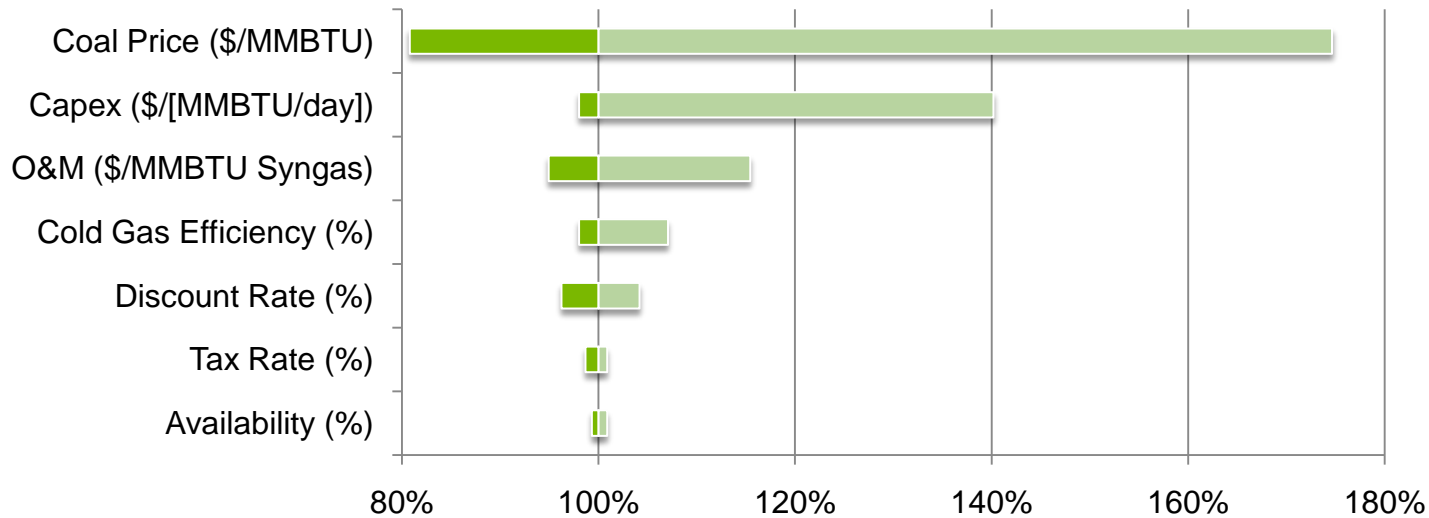
<b>Location</b>	Henan Province, China - Mazhuang Coal Chemical Industrial Park
<b>Partner</b>	Yima Coal Industry Group Co.
<b>Capacity</b>	2400 tpd (2 operating & 1 spare)
<b>Product</b>	Integrated coal gasification to methanol
<b>Fuel</b>	Sub-bituminous; 30 – 38% ash
<b>Structure</b>	75% Yima / 25% SES
<b>Mechanical Completion</b>	3Q 2012 - COD – approx 6 months later



# Gasification Project Economics

# Project Economics Impact of Fuel Quality

Key parameters Impacting Cost of Syngas



Key parameters a licensee can control when selecting gasification technology:

- Fuel price
- Capex
- Efficiency
- Availability

# In Summary



## SES

- A global energy company
- U-GAS® is a proven, well-developed, and low cost gasification platform

## U-GAS® Technology

- Fuel flexible
- Simple system enhances reliability
- Lower life cycle costs
- Lower operating costs

## Project Participation

- Licensing through technology transfer and equipment supply
- Carried interest in strategic projects

