

GE Energy

# GE's IGCC Experience



**Benu Pillai**

# Growing gasification in multiple segments

## IGCC/Coal to Power



- Low cost fuels/feedstock
- Reduced emissions
- Fuel diversity



**Coal to  
Chemicals**

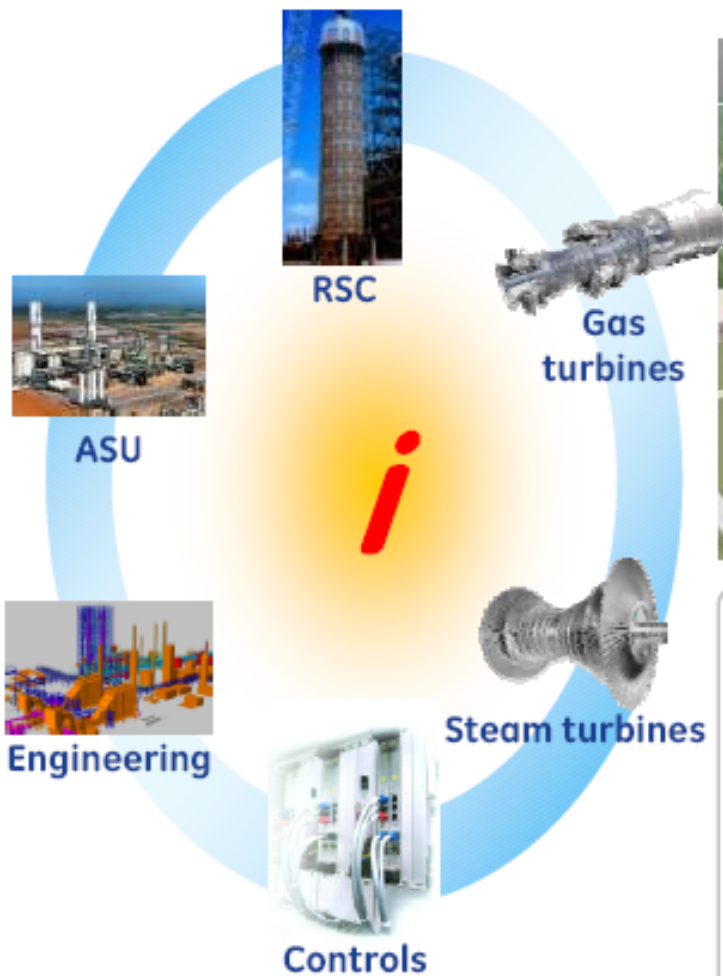


**Refinery  
Polygeneration**



**Coal to  
Liquids (CTL)**

# GE & Bechtel IGCC reference plant



## Reference plant well defined

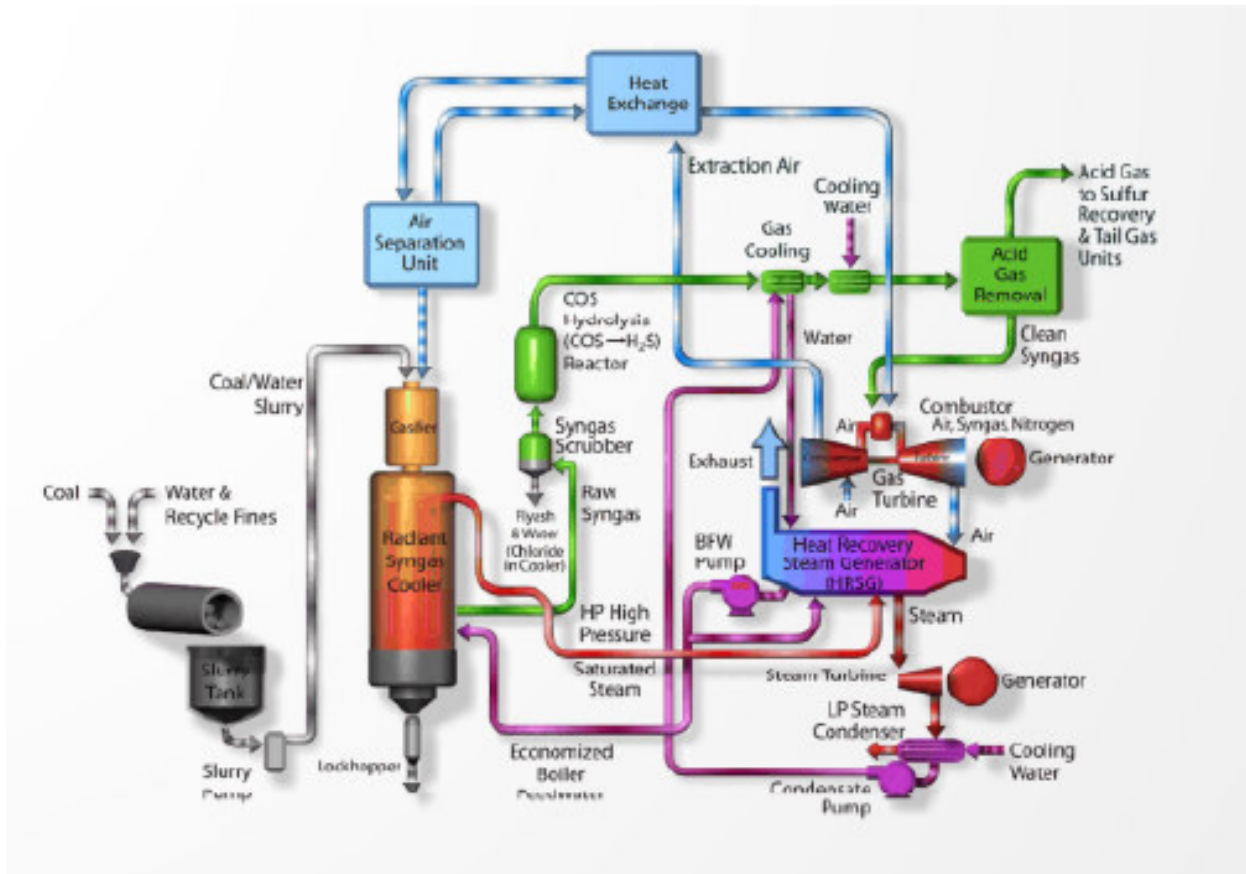
- 2 +years engineering & 3 FEED's complete
- Full performance & availability models developed
- Bulks quantified (pipe, steel, concrete)
- Emissions for permit & detailed EPC schedule complete

## Value proposition:

- Cycle: 12 month reduction in Feasibility/FEED
- Flexible contracting structure: LSTK, EEPs, equipment
- Wide bituminous fuel envelope: Sulfur, ash, chlorides
- Carbon capture capability
- Operability

7

# IGCC plant integration & control



## Air integration

- Extraction air from GT
- N<sub>2</sub> for NO<sub>x</sub> management

## Thermal integration

- High pressure steam from RSC to HRSG
- BFW management with Auxiliary systems)

## Syngas cleanup

- Heat integration ... use low level process heat to remove sulfur

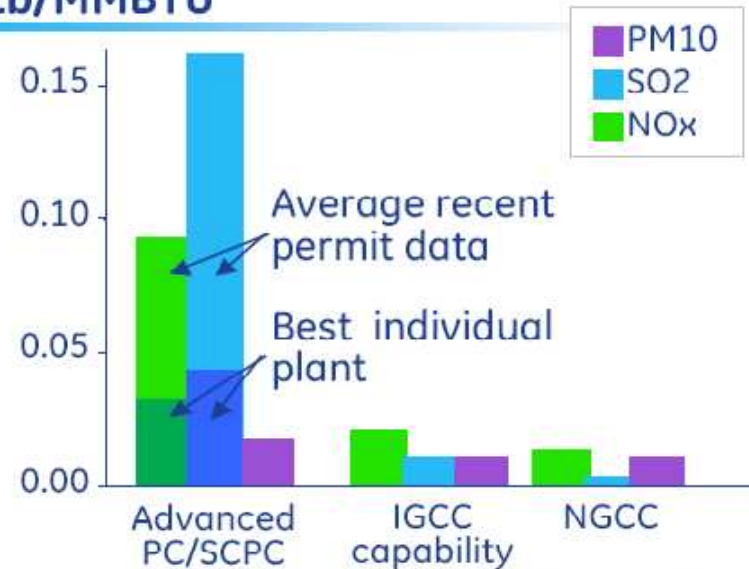
One integrated control system

# IGCC reference plant performance

Net Output <sup>1</sup>	630 MW
Net HR (HHV) <sup>1</sup>	8751 Btu/kWh
Availability Target	92%, 85% on syngas
Net Eff. <sup>1</sup>	39% HHV
Turndown	50%
Coal type	Eastern Bituminous Coal
Fuel Envelope	Up to 14% Ash 0.8 – 4% Sulfur Chlorides 2500 ppm

<sup>1</sup>Plant performance - will vary according to specific coal and site conditions

## Lb/MMBTU



Source: GE internal data, average of 30 permits granted, applications and publicly reported emissions, Aug 2006

## IGCC reference plant benefits compared to supercritical pulverized coal

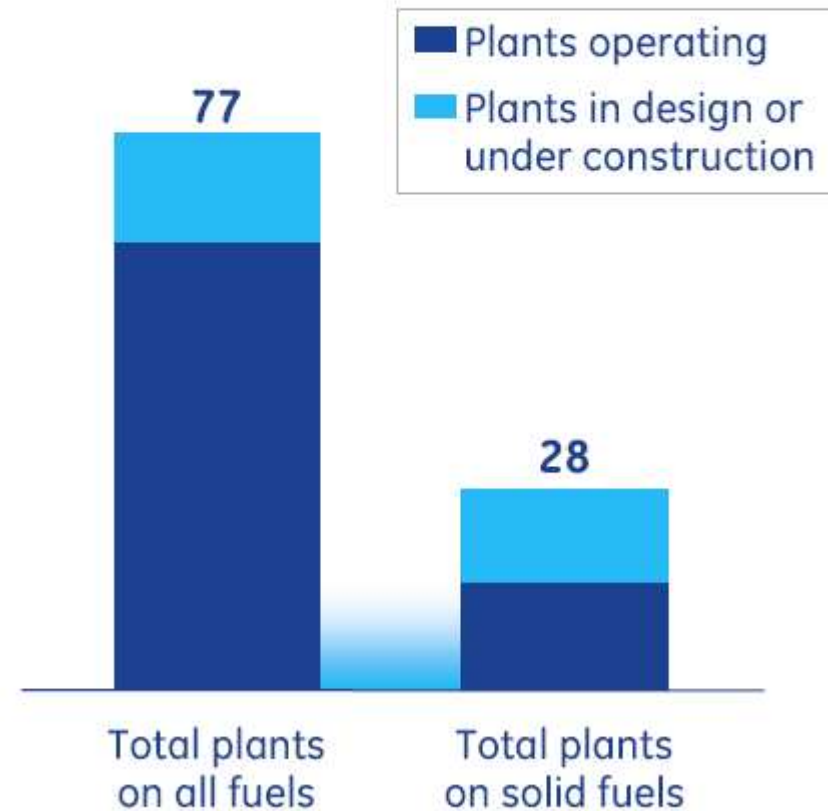
- 33% less NO<sub>x</sub>
- 75% less SO<sub>x</sub>
- 40% less PM<sub>10</sub>
- 90% + Hg removal
- CO<sub>2</sub> capture ready

# GE's gasification experience & IGCC leadership

- Gasification leader since 1948 with 62 facilities operating worldwide
- First coal gasification plant in 1978
- 21 gas turbines operating on syngas ... over 1 million operating hours
- IGCC leader: >3 GW with GE technologies
- >6 centuries team gasification experience
- TECO... operated > 12 million MW-hours
- 25 projects worldwide, which capture CO2

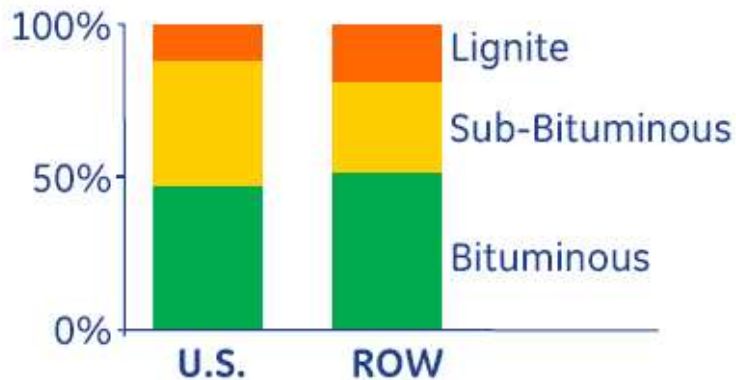


## GE's gasification experience ~120 vessels in operation

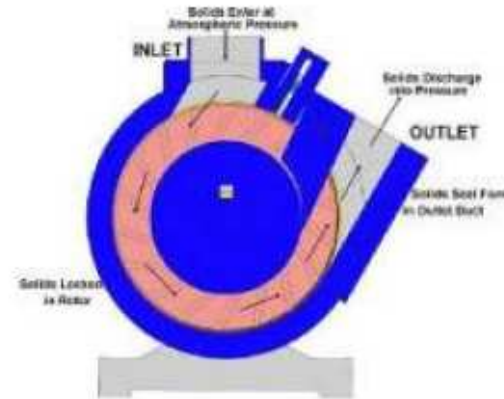


# Expanding the fuel envelope

## Coal range handled



## High Pressure Feed Pump Technology....



Coal Characteristic	Bituminous	Sub-Bituminous	Lignite	US Ref Plant capability
Btu/lb	10,000 - 12,500	8,000 - 8,900	5,100 - 7,000	
Ash (%)	6 - 14	4 - 7	8 - 25	<b>Up to 14%</b>
Sulfur (%)	0.8 - 4	0.1 - 0.6	0.5 - 2.5	<b>Up to 4%</b>
Challenges	Chlorides	Moisture, Ash Fusion Temp	Moisture, Heating value	<b>Chlorides up to 2,500 ppm</b>
<b>US Ref Plant capability</b>	<b>&gt;90%</b>	<b>&gt;90%</b>	<b>Future (?)</b>	

# Utilizing a Diverse Global Team >300 Technologists



**Houston, TX** – process & product design & IGCC experience

**Niskayuna, NY** – materials, design, system analysis

**Shanghai, China** – materials, chemistry, instrumentation

**Schenectady, NY/ Salem, VA** – controls, simulation

**Bangalore, India** – computational, experimental

**Greenville, SC** – design, adv materials & manufacturing

**Irvine, CA** – gasification modeling & experimental experts

**Warsaw, Poland** – reliability and maintenance analysis

**... to lower CAPEX, plus increase efficiency & RAM**

GE Energy

# GE's IGCC Experience



**Benu Pillai**