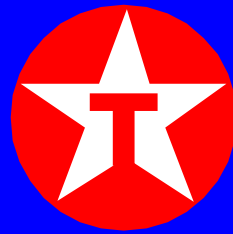


Environmental Enterprise: Carbon Sequestration using Texaco Gasification Process



First National Conference on Carbon Sequestration

May 16, 2001

Jeff Seabright

Texaco Inc.



Presentation Highlights

- **Texaco and climate change**
- **Introduction to gasification**
- **Environmental benefits of gasification**
- **CO₂ capture & sequestration**
- **Challenges going forward**



Texaco's Climate Change Policy

- **Know enough to take action now**
- **Greenhouse Gas Emissions (GHG) management**
 - Annual emissions inventory ('97-00) with 3rd party verification
 - Mandatory GHG projections review for new projects
 - Integrated with business planning
 - GHG projections in strategic planning cycles for all Business units
- **Technology Pathways**

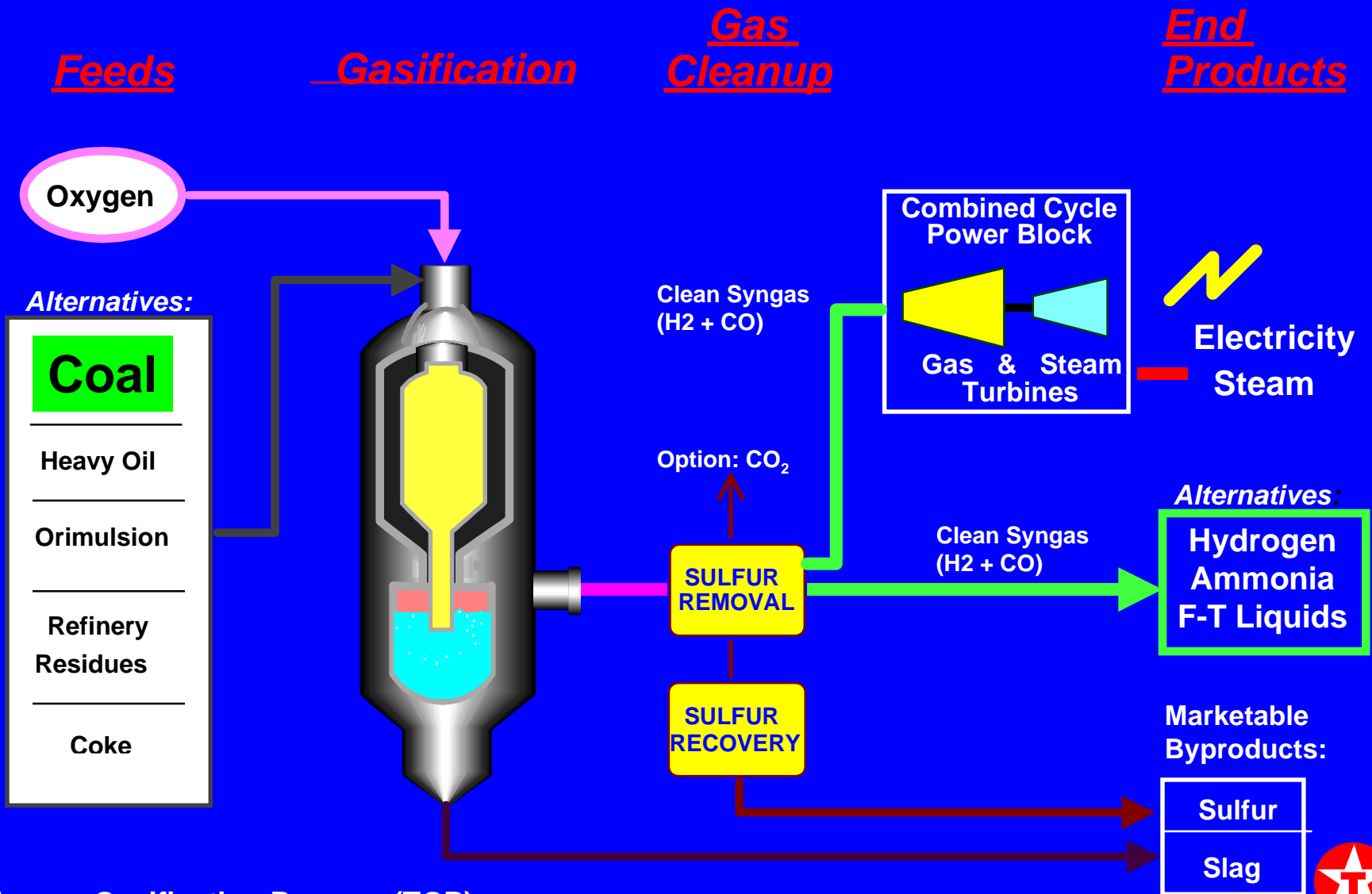


Texaco's Commitment to Advanced Energy Technology

- **Texaco Power & Gasification (TP&G)**
 - Licensing and equity interest in projects
- **Energy Conversion Devices (ECD)**
 - Joint venture and equity interest
- **CO₂ Capture Project (CCP)**
 - Founding member



Coal IGCC Process¹

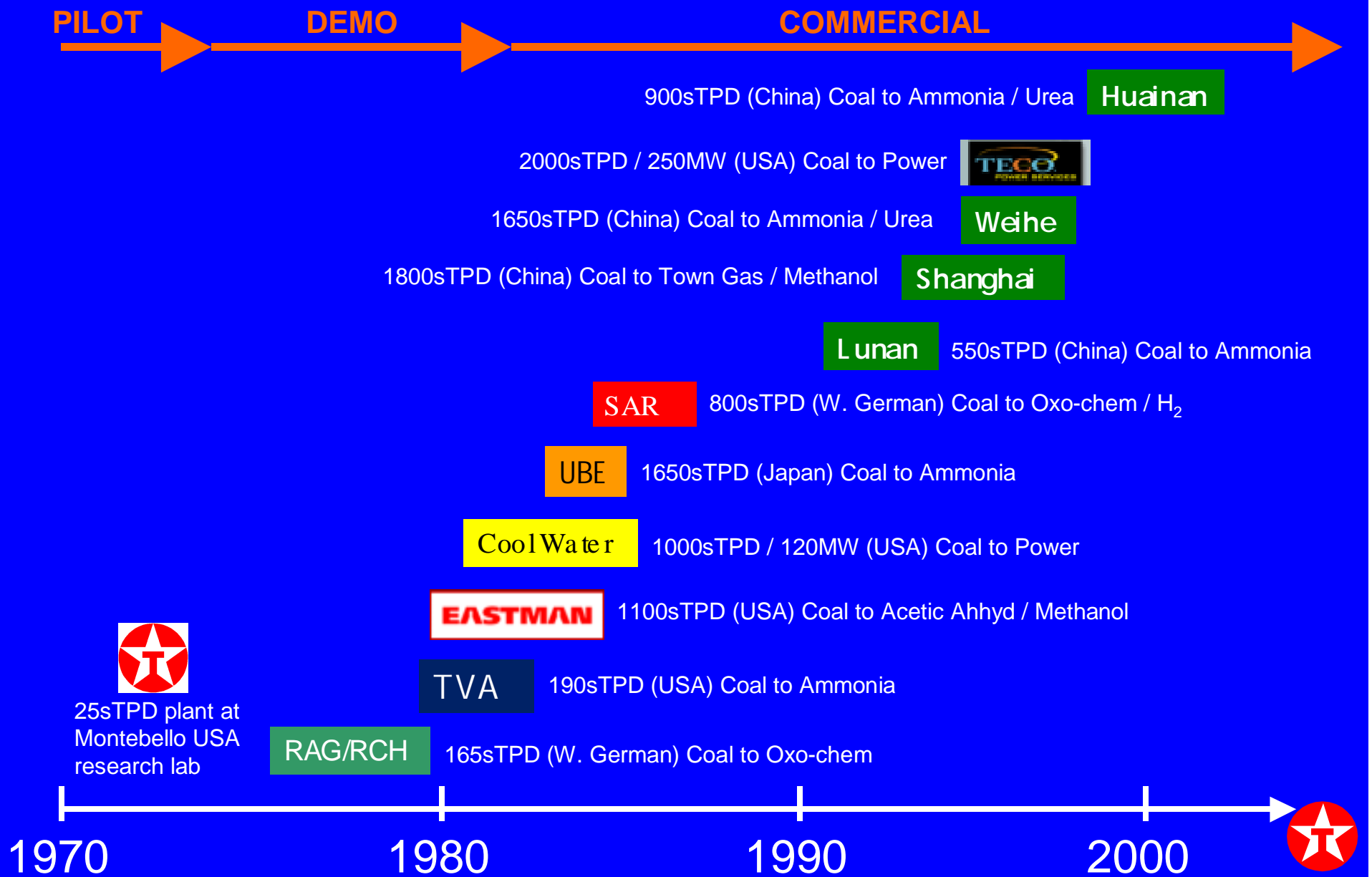


1 Texaco Gasification Process (TGP)



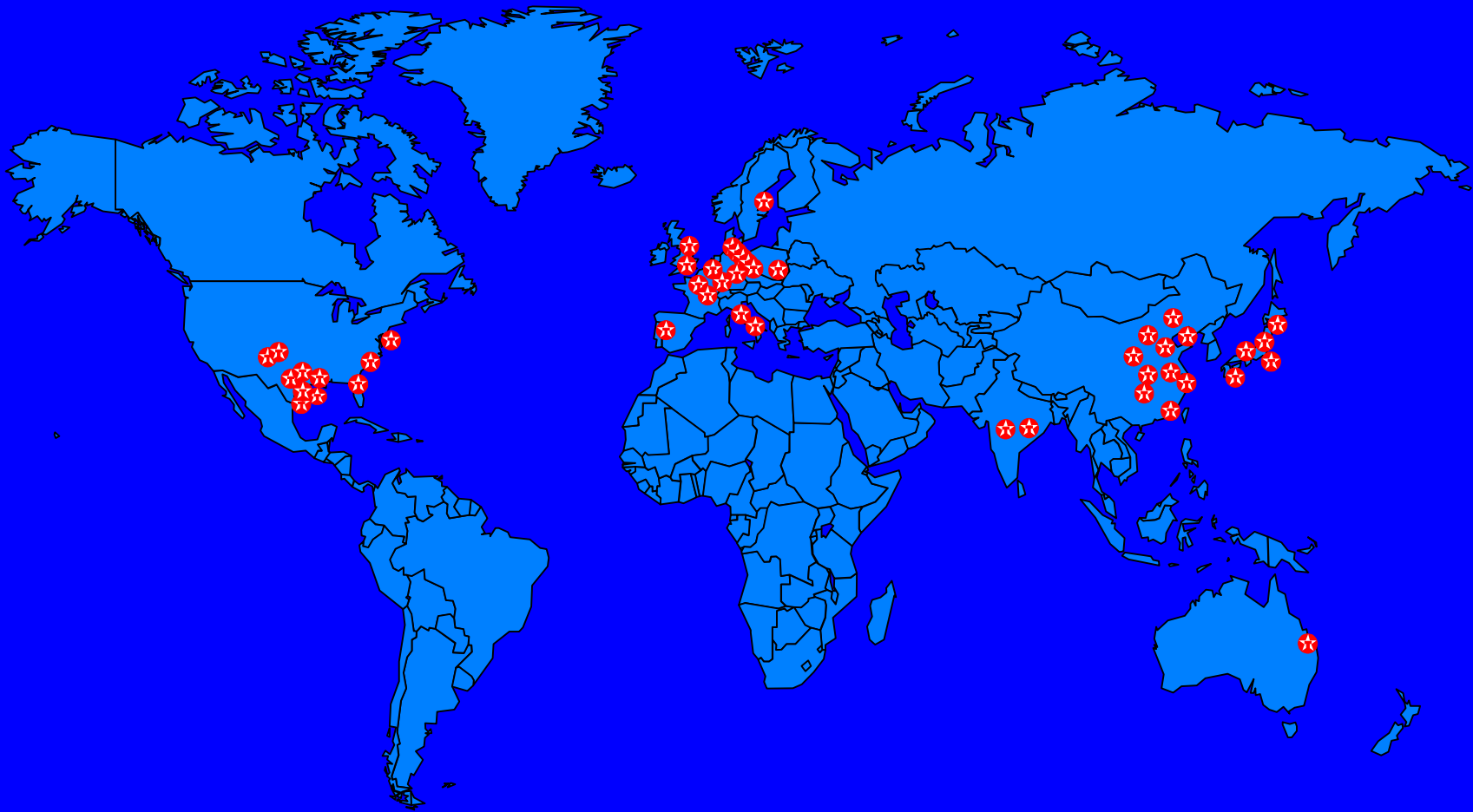
Evolution of TPG IGCC/Coal Gasification¹

1 TGP



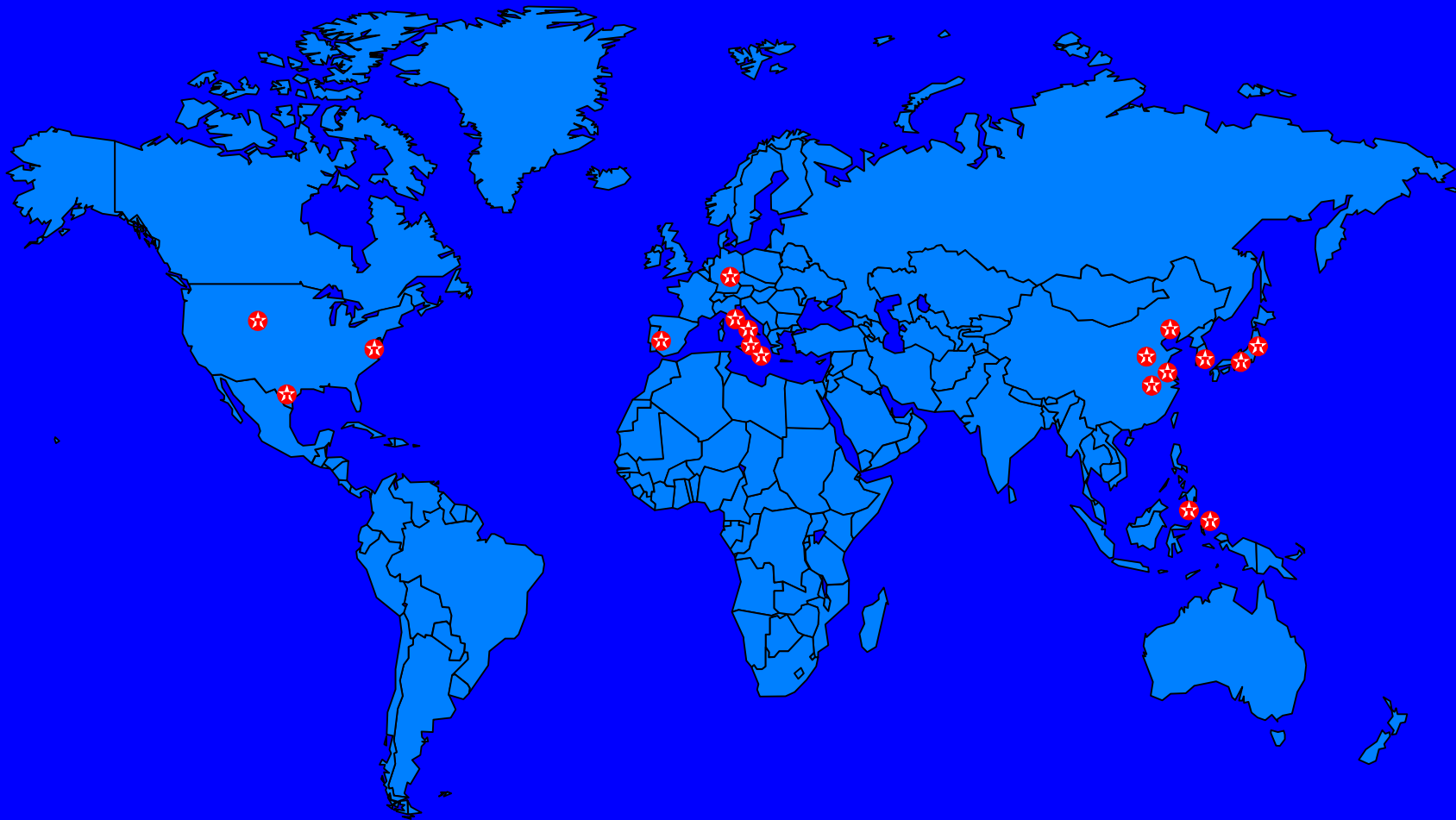
Texaco Power & Gasification

60 Commercial Plants in Operation



Texaco Power & Gasification

12 New Plants in Engineering/Construction

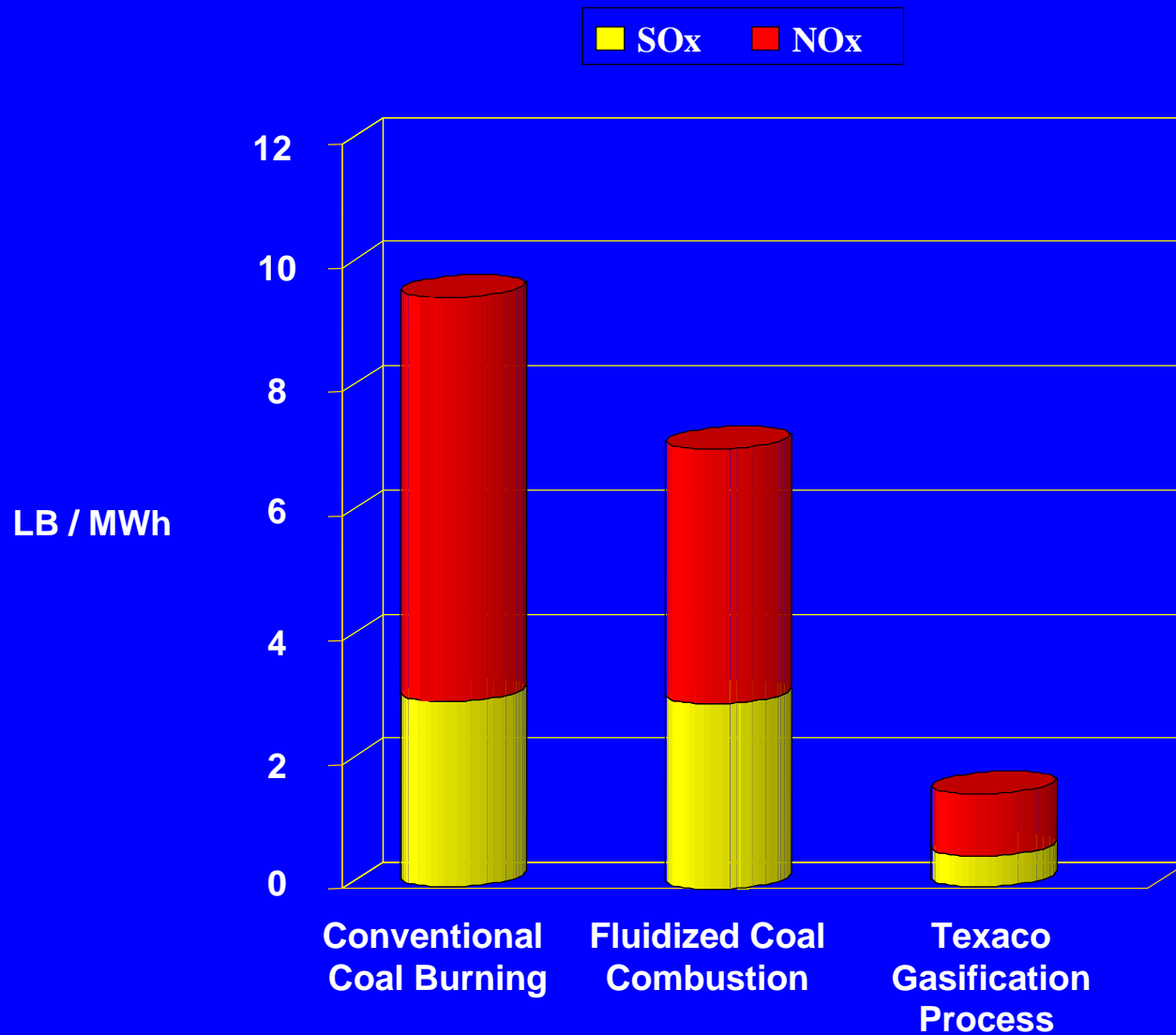


Emissions Comparison

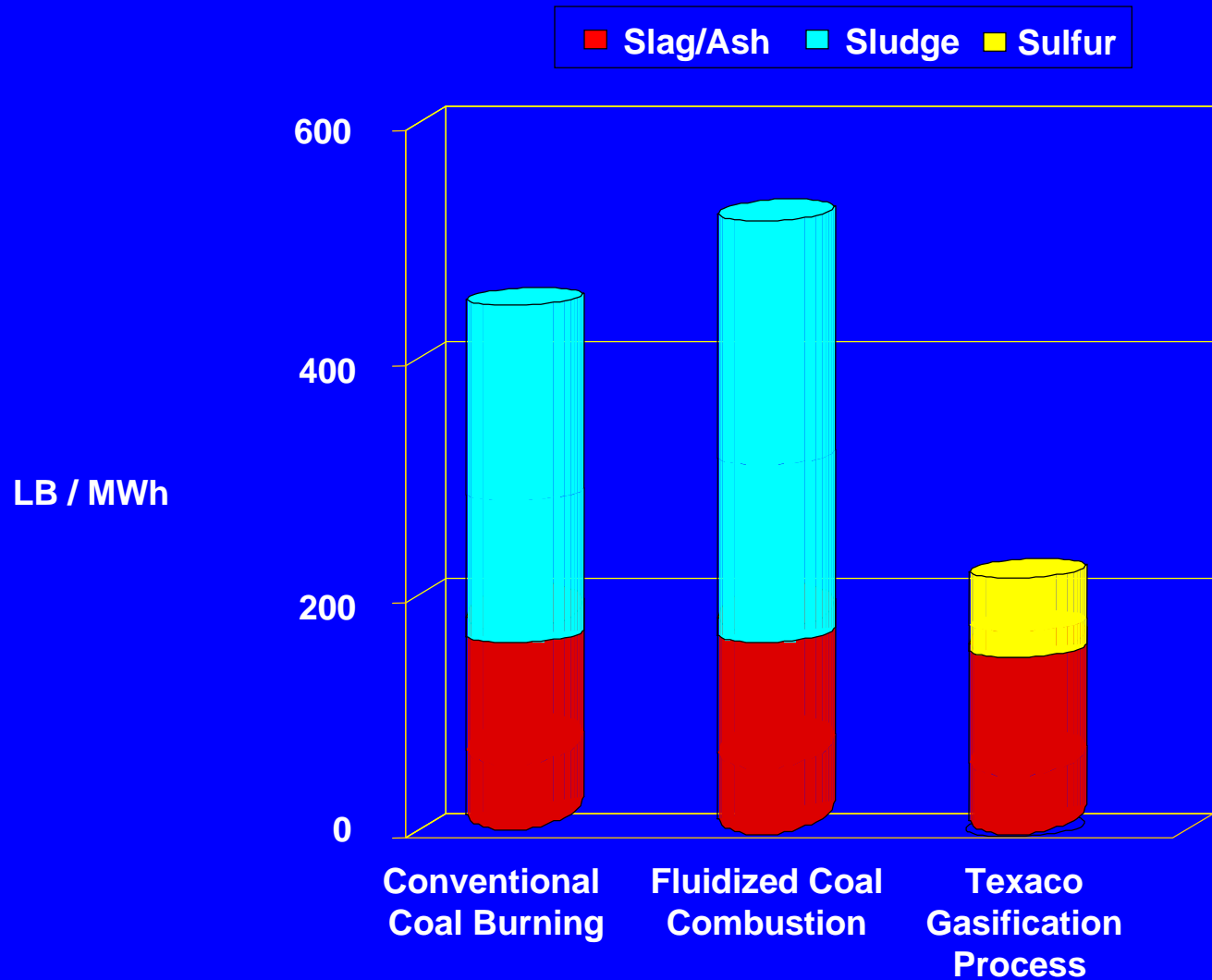
	<u>Natural Gas Combined Cycle</u>	<u>Coal IGCC</u>	<u>Coal Fluidized Bed</u>
SCR	Yes	No	Yes
Stack Gas Scrubber	No	No	Yes
NO _x	3 ppm	<9 ppm	150 ppm
Sulfur Recovery	—	>98%	95%
CO ₂ (lb/kWh)	0.81	1.95	2.26



Air Emissions Comparison



Solid Emissions Comparison



Emerging Emissions Issues

- **PM_{2.5} – Mercury - Toxics**
 - *Coal IGCC process characteristics minimizes releases due to closed system*
 - *Sulfur removal process cools syngas and removes potential contaminants*
 - *Capacity de-rating is unnecessary*
 - *If further processing necessary, syngas is low volume, pre-combustion*



GHG Benefits of Coal IGCC

- **Existing coal options have efficiencies of 35% or less.**
- **Current Coal IGCC technology achieves 40%-43% efficiency, while next generation will be 44%-49%.**
- **Cogeneration/Poly-generation offer the opportunity for further efficiency improvements (>60%), reduce GHG emissions and improved economics.**



Additional GHG Benefits

- **No CO₂ released from limestone during scrubbing or conversion to lime.**
- **Less solids handling/mining/transportation (No Limestone In / Solid Waste Out).**
- **Sulfur co-production (Avoidance of sulfur mining production)**



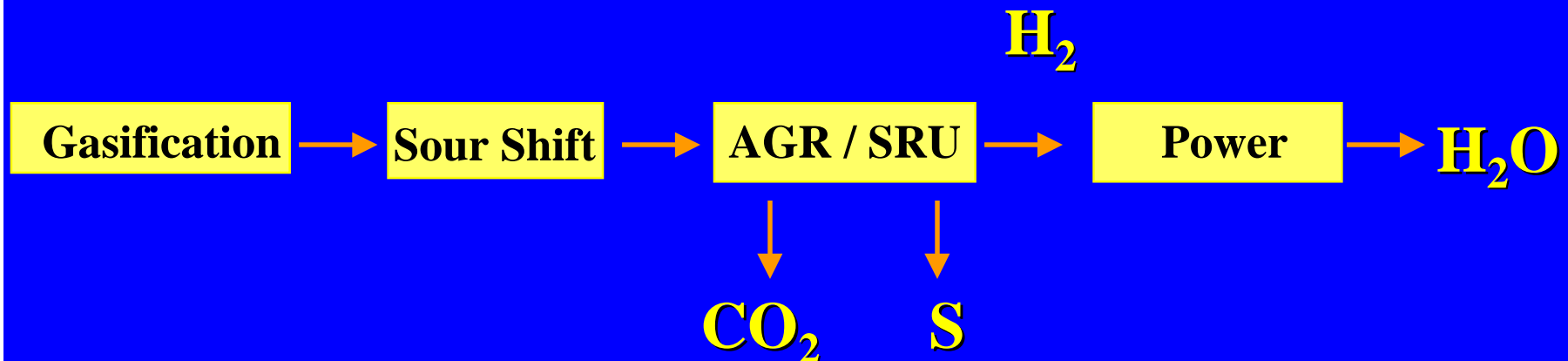
CO₂ Control & Sequestration

Opportunities

- **IGCC as a Pre-Combustion CO₂ Capture Technology**
 - Produces a high pressure and high quality CO₂ stream
 - CO₂ stream can be used for EOR or CBM projects or injected into saline aquifers
 - Increases overall plant capacity & efficiency
- **Concept has been demonstrated in 8 operating TGP ammonia projects in China**



IGCC as a Pre-Combustion CO₂ Capture Technology



- High Pressure CO₂ byproducts allow for easier CO₂ sequestration.



Challenges

- **Carbon offtake market and price**
- **Carbon offset credit market**
- **Viability of non-market sequestration options**



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