Workshop on Gasification Technologies
March 2-3, 2006
Tampa, Florida

COFFEYVILLE RESOURCES™

Getting off the Natural Gas Habit
Coal to Nitrogen Fertilizers

Neal Barkley, P.E.
Plant Manager

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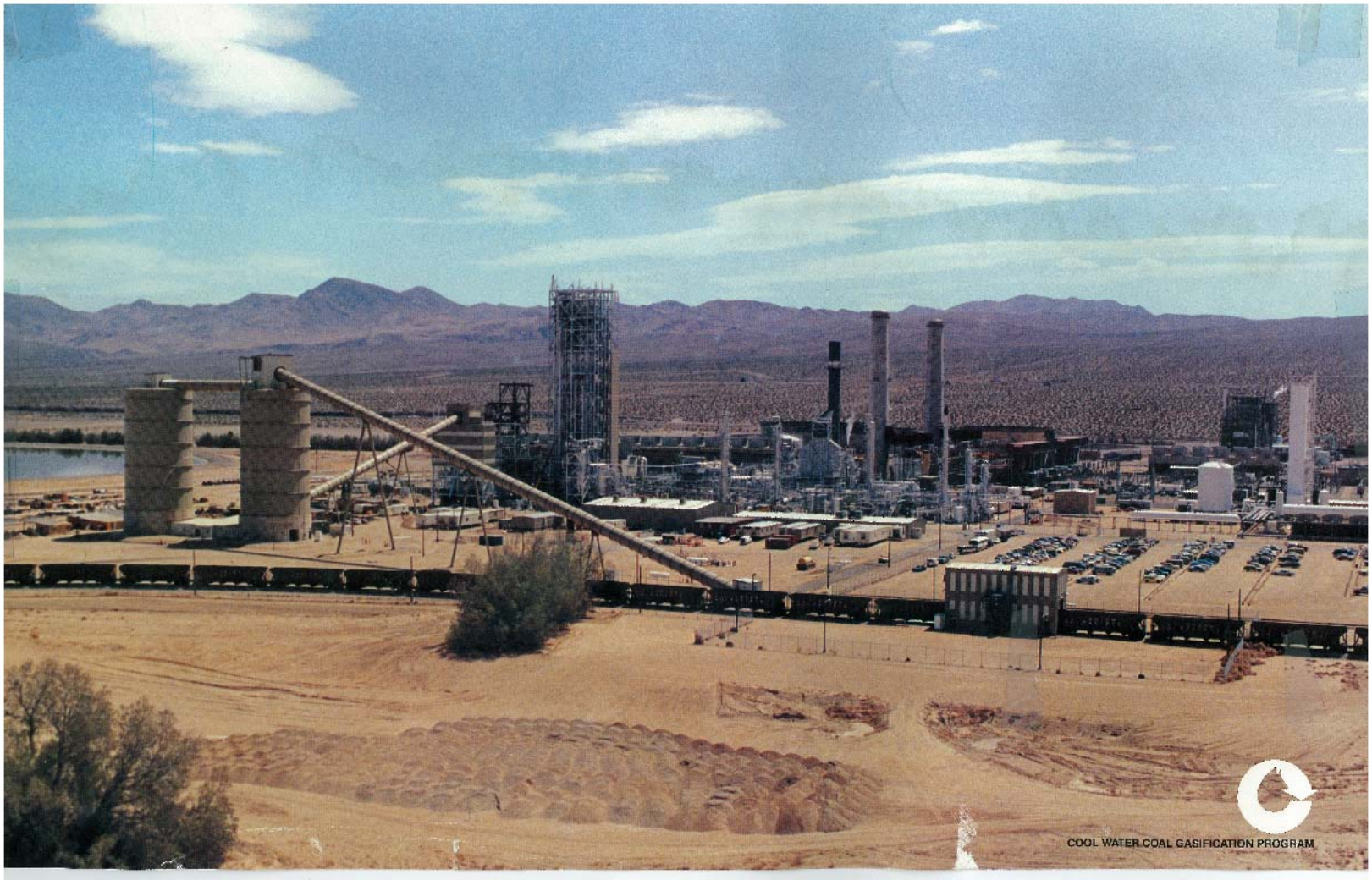
Coolwater Demonstration Project



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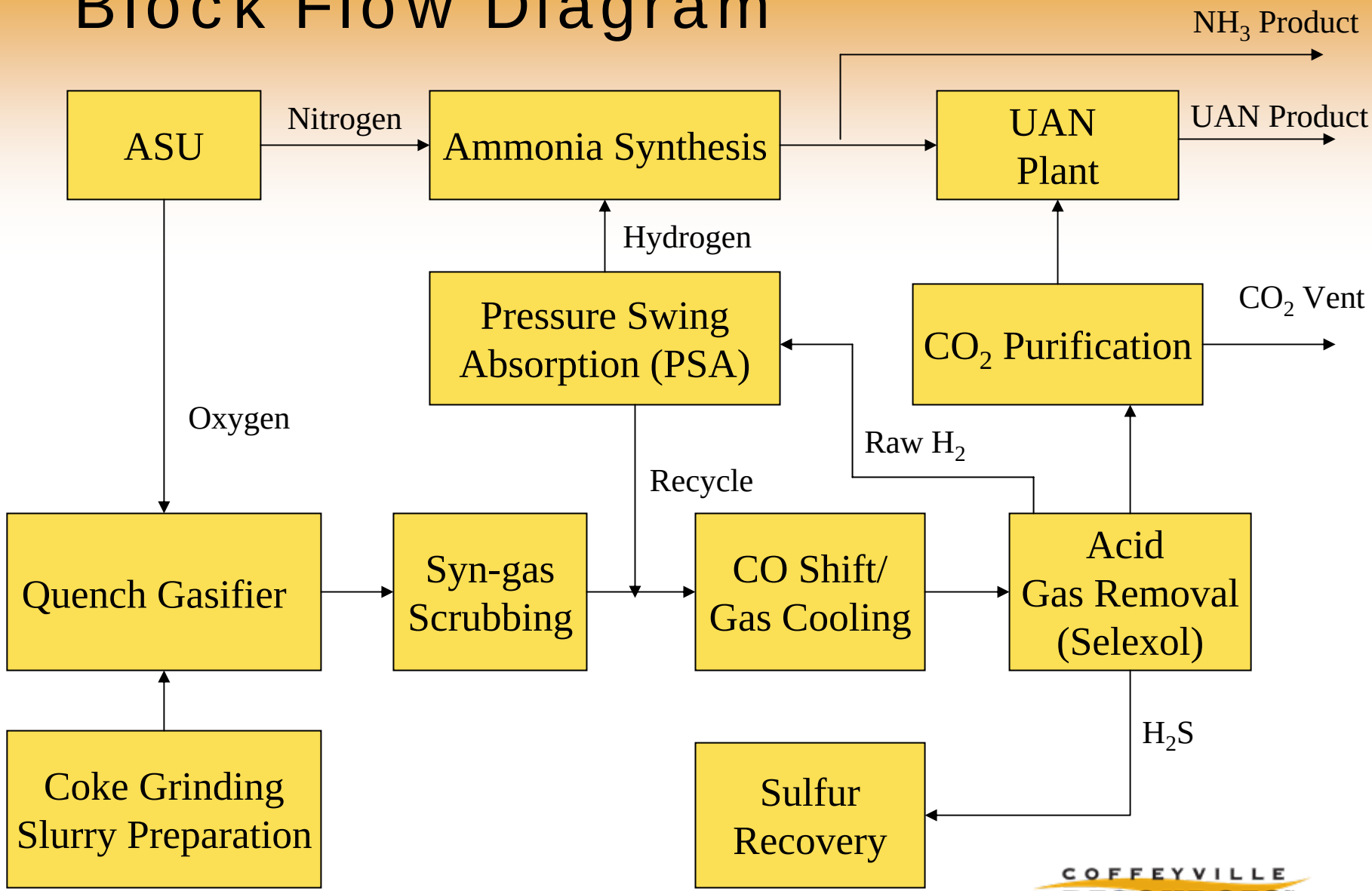
Coffeyville Nitrogen Plant

Block Flow Diagram



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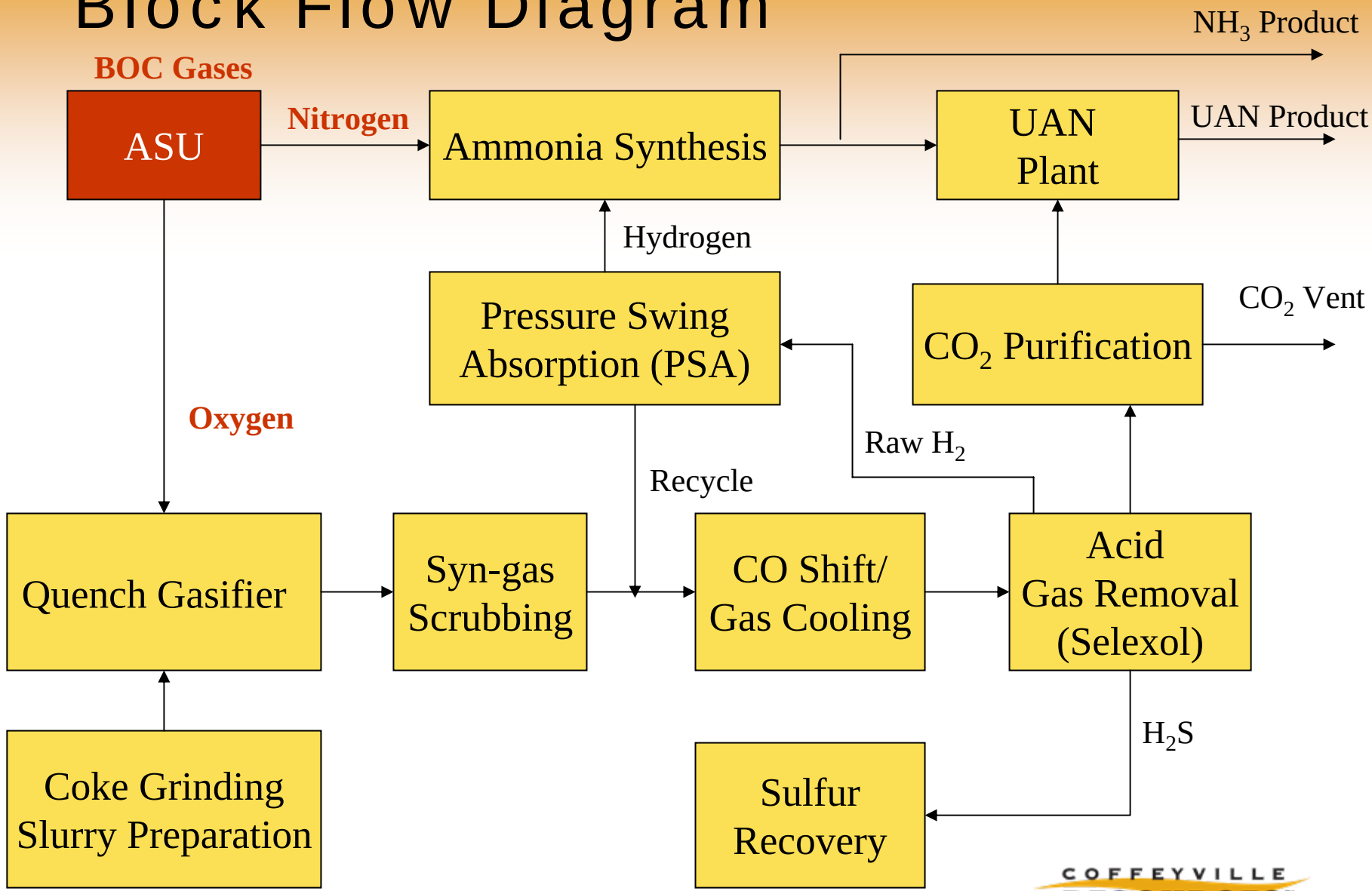
Block Flow Diagram



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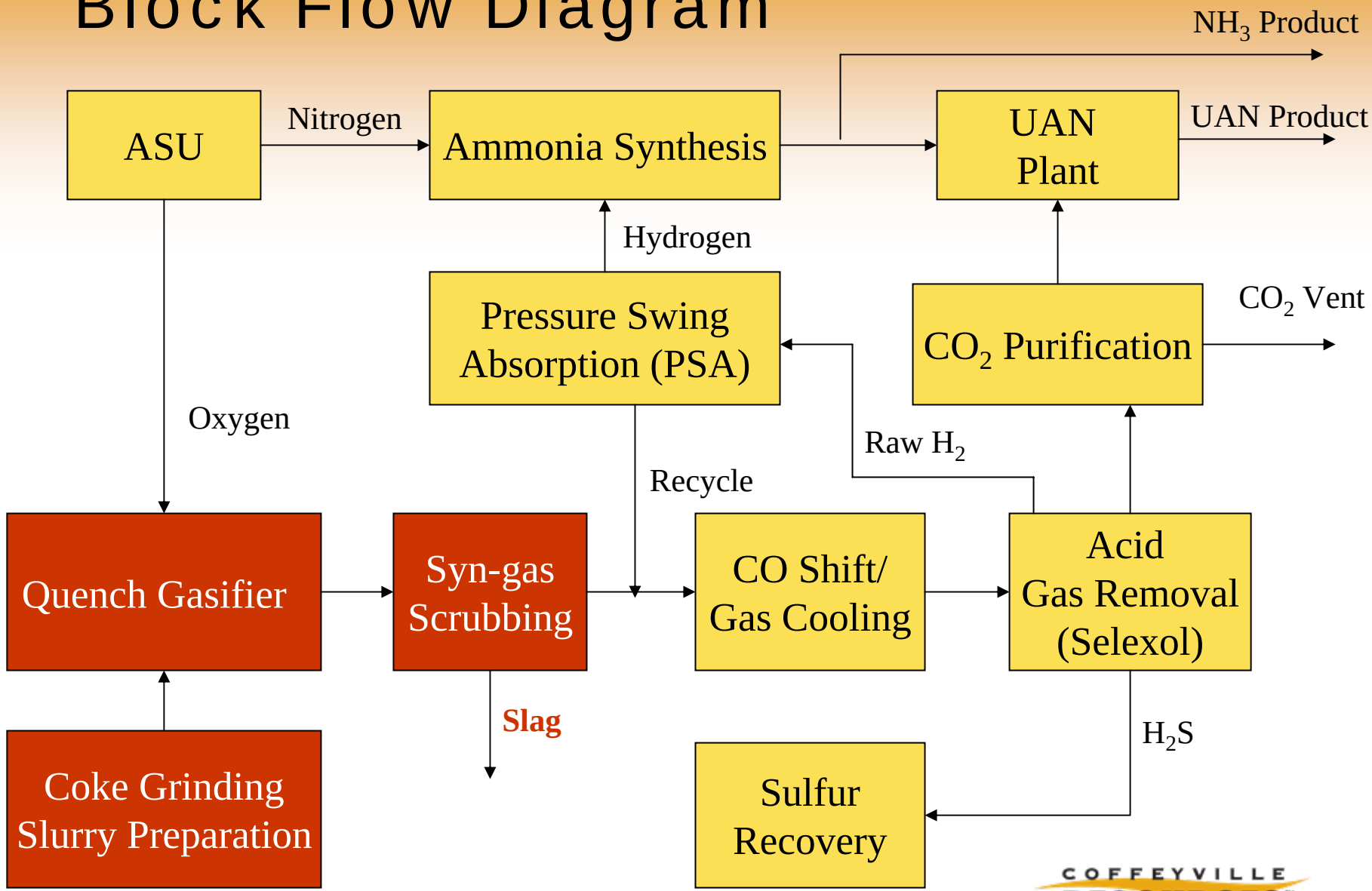
BOC Gases Air Separation Unit

Block Flow Diagram



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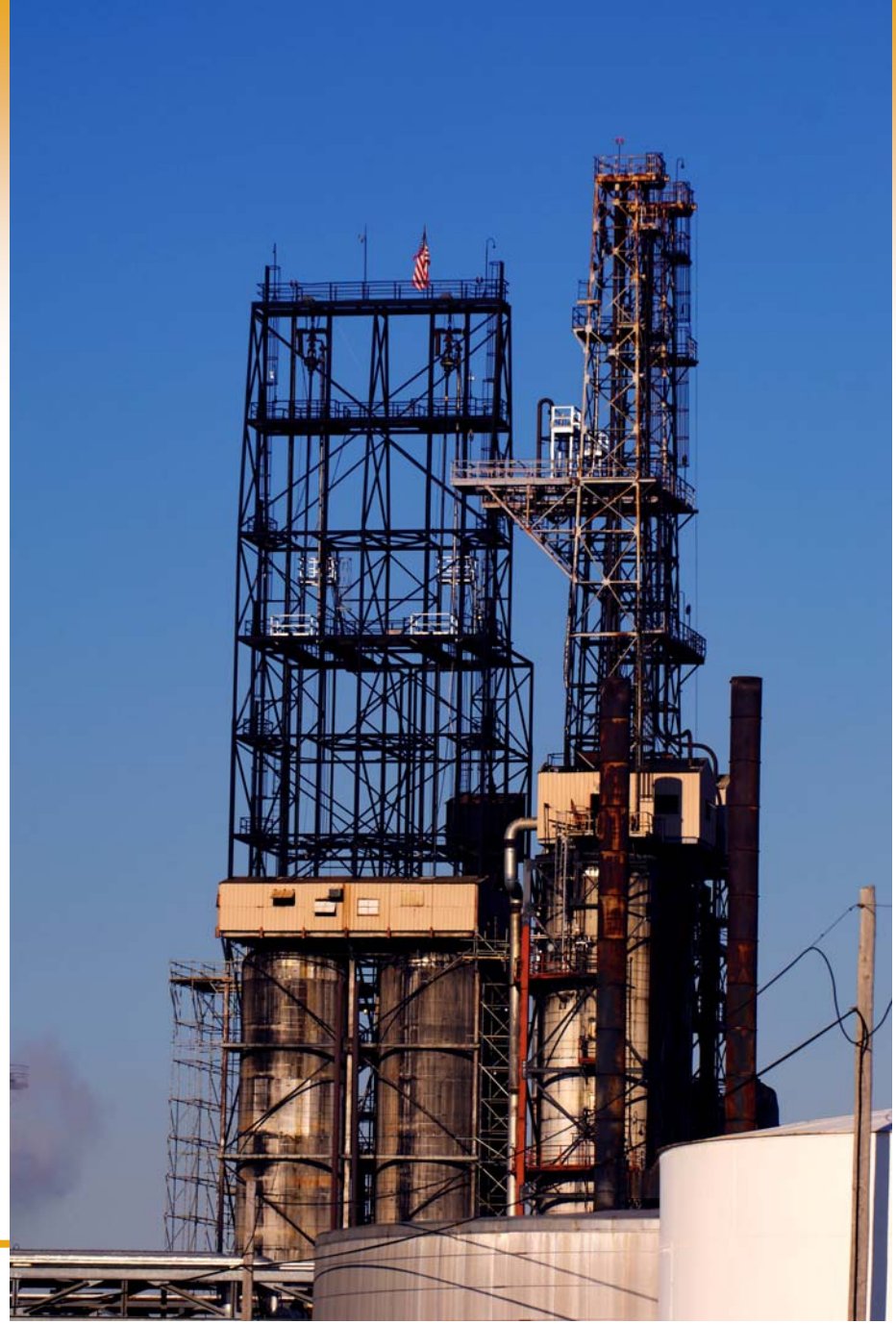
Refinery Cokers



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Coke Handling

Coke Conveyor and Rod Mill Structure

Main and Spare Gasifier Structures

Main Gasifier Vessel

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Slag

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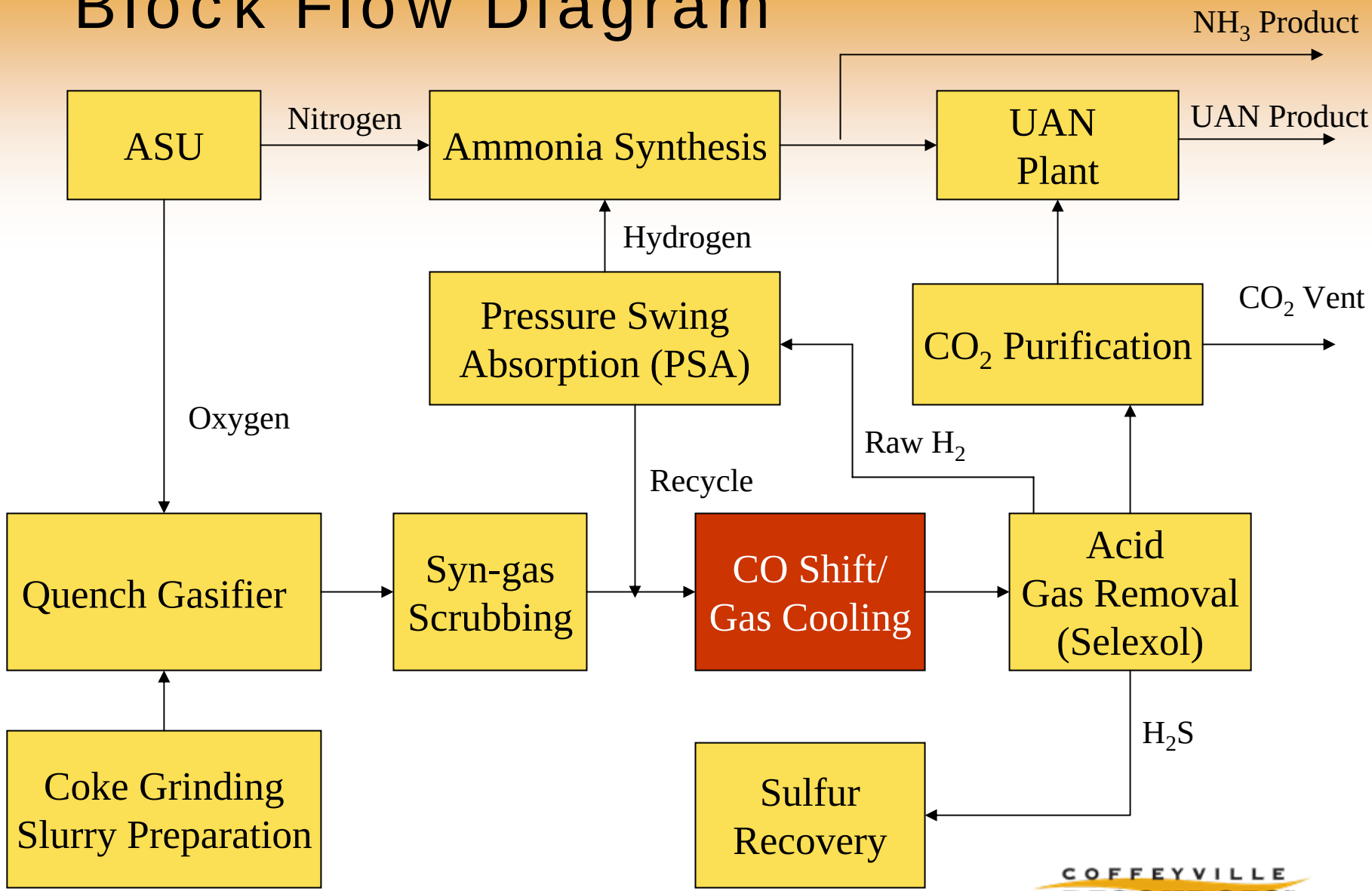
Block Flow Diagram



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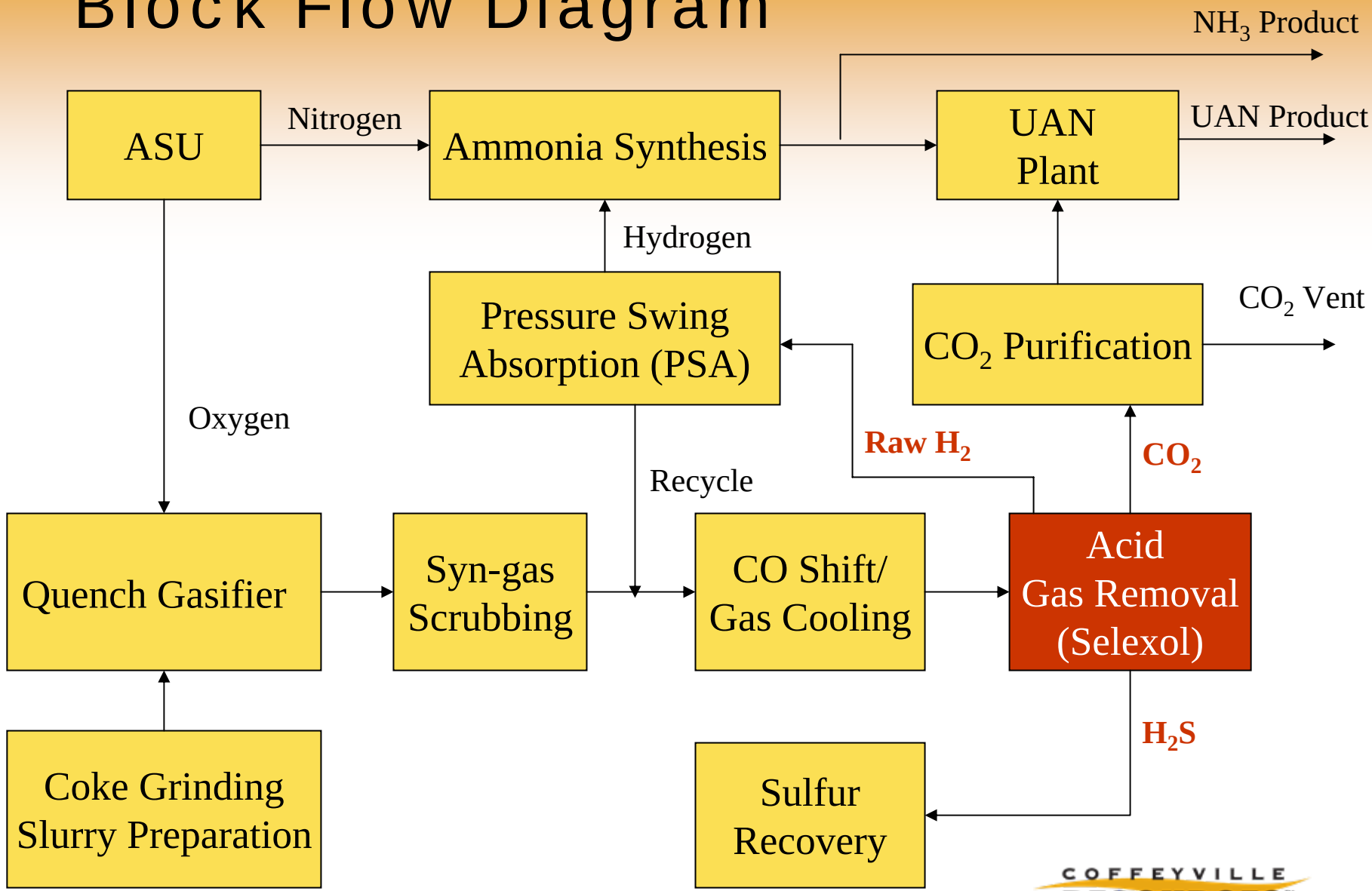
Block Flow Diagram



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CO_2 Absorber

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H2S Concentrator and Stripper

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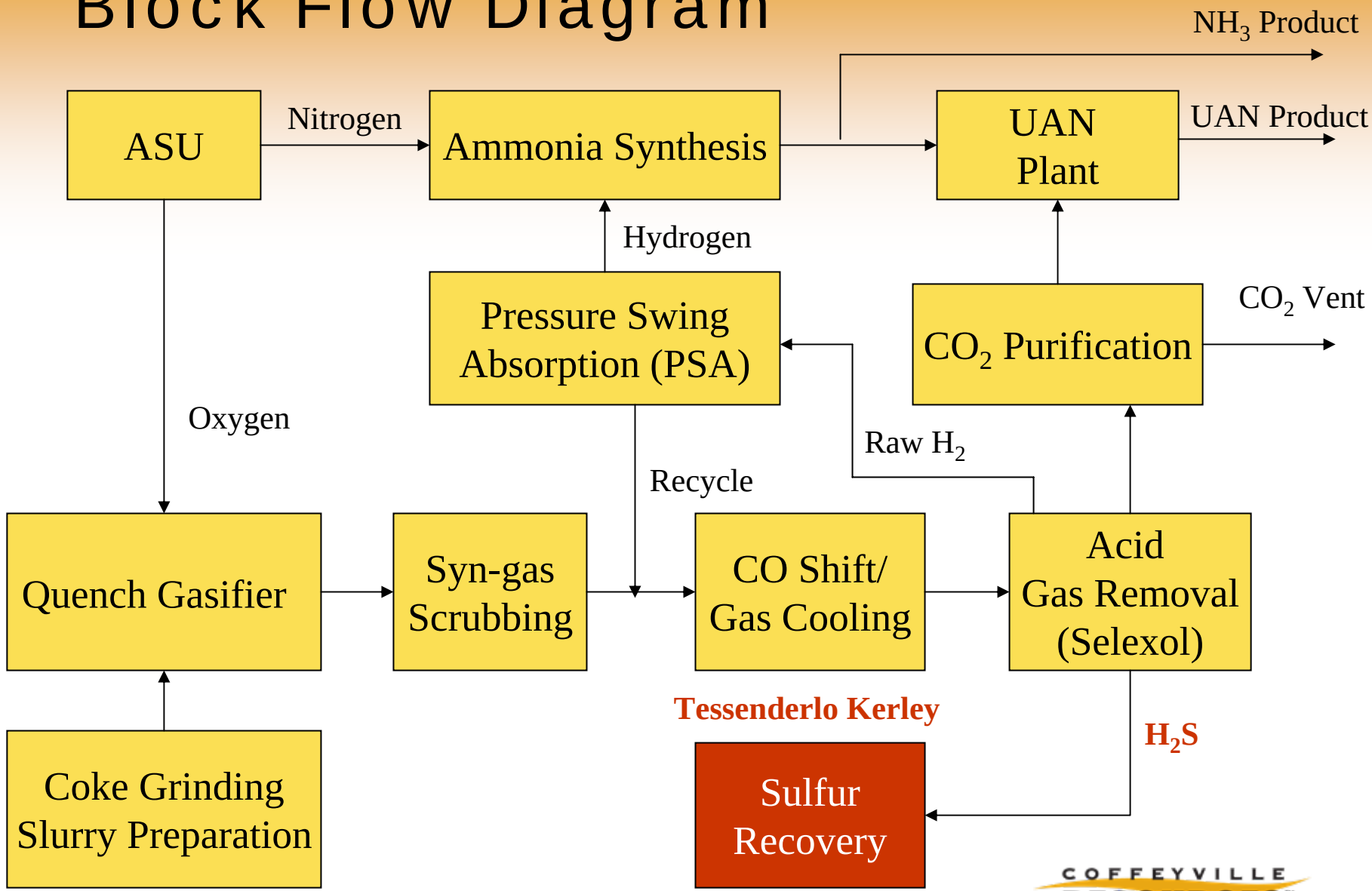
Block Flow Diagram



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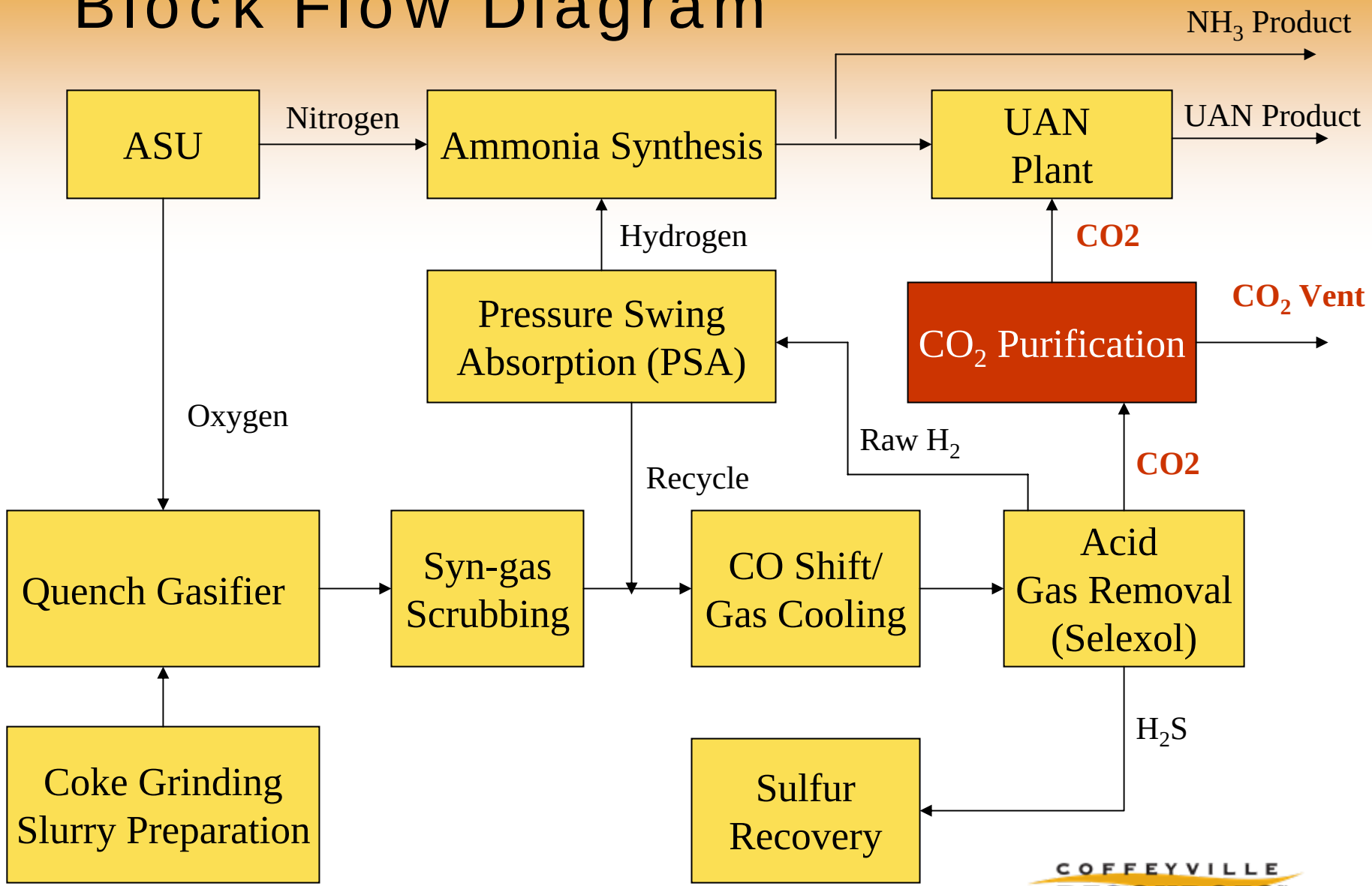
Block Flow Diagram



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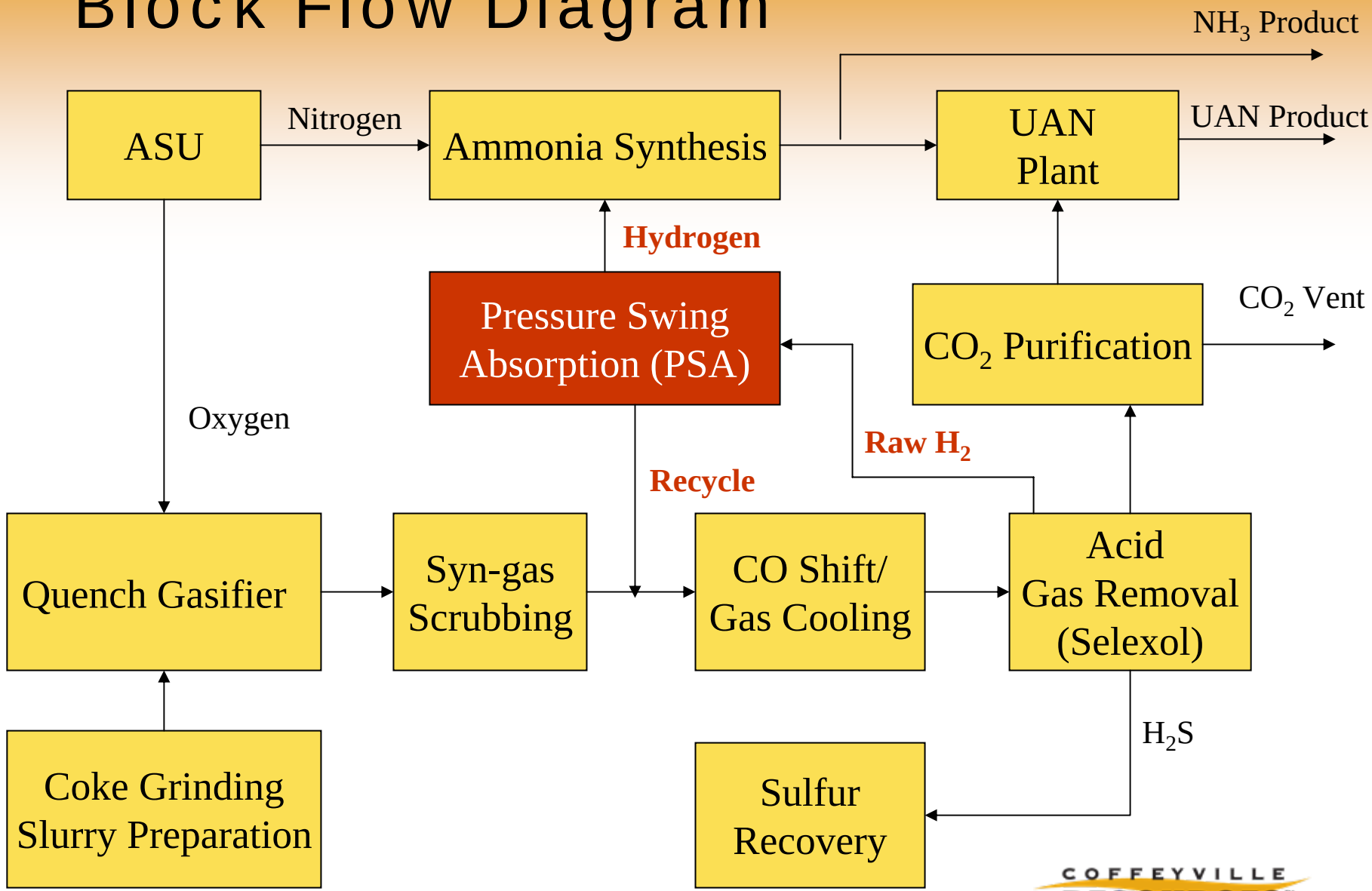
Block Flow Diagram



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PSA Vessels

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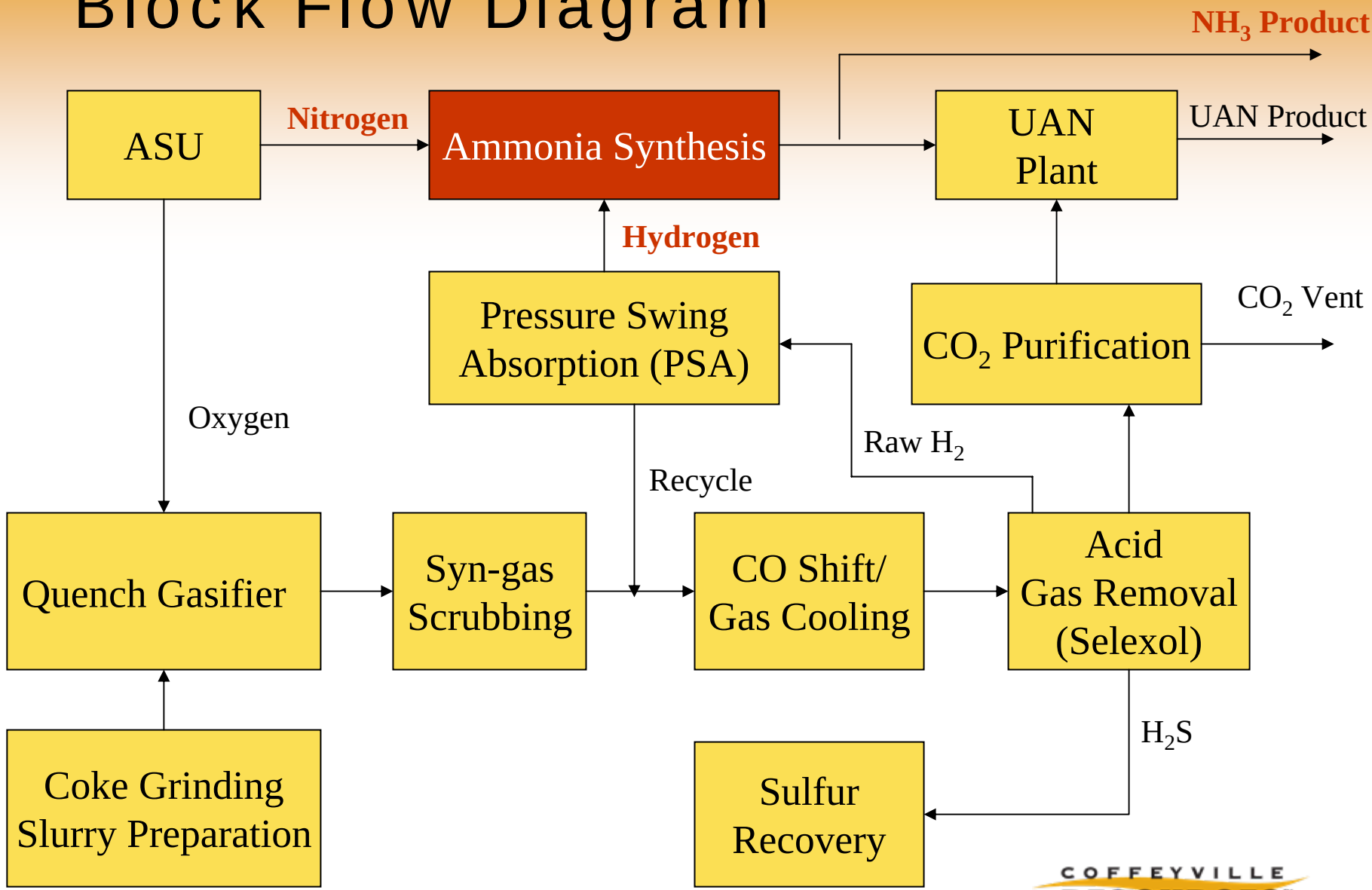
Block Flow Diagram



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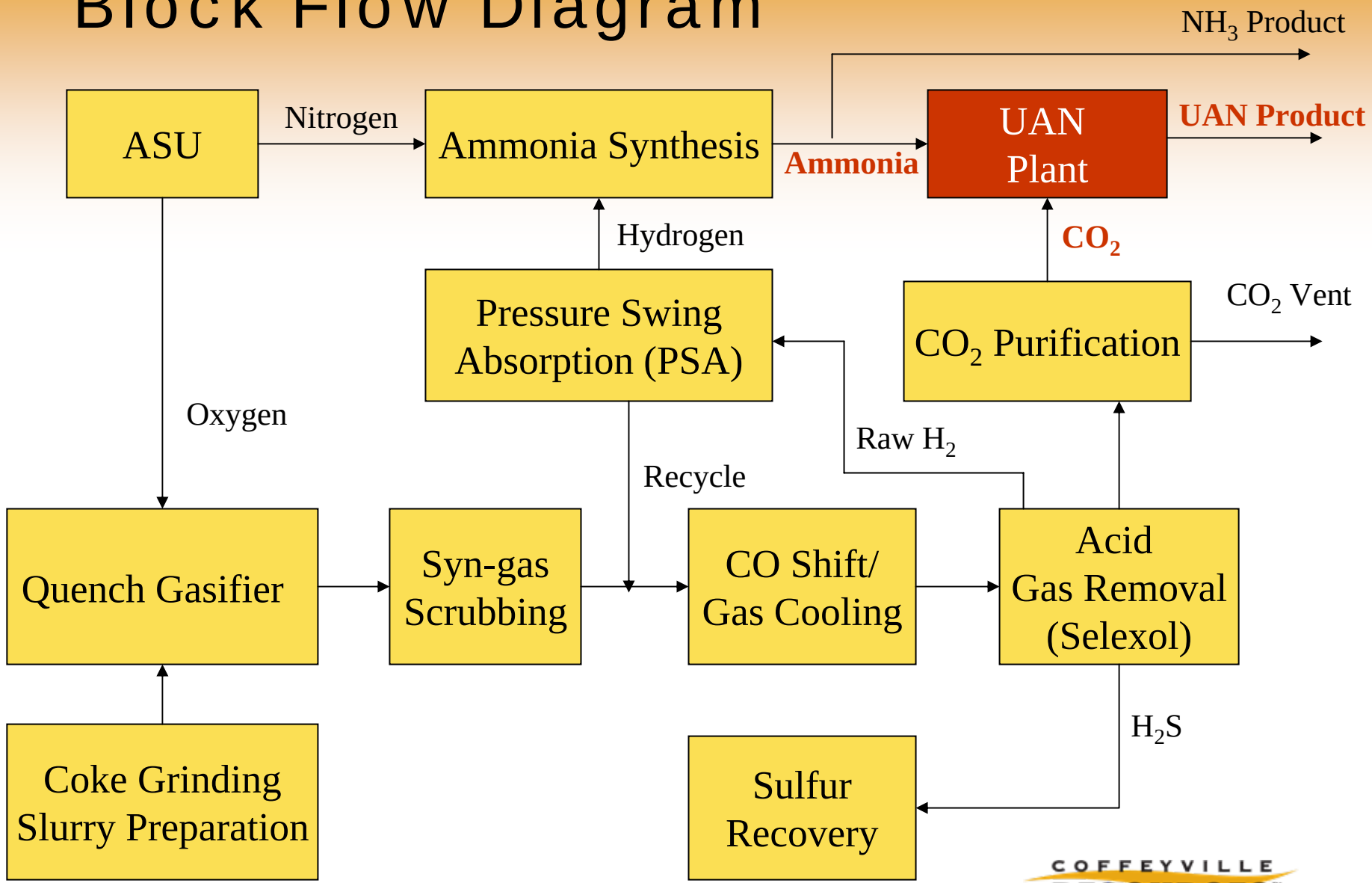
Ammonia Synthesis and Refrigeration

Syn-gas and Refrigeration Compressors

Ammonia Storage Tank

Block Flow Diagram



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UAN Plant

UAN Rail Loading Facility

Operators at work in the control room

Nitrogen Fertilizer 101

- Nitrogen is a basic nutrient for all plants.
- It does not build up in the soil, so it needs to be applied each growing season.
- Ammonia is the basic building block for nearly all fertilizers that contain nitrogen.
- In 2005, the US produced 8.7 million tons of ammonia.
- In 2005, the US consumed 14.7 million tons of ammonia.
- **Nearly all was produced using natural gas!**

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Nitrogen Fertilizer 102

Ammonia cash cost build-up (example)

	Gas Cost	$ 6 per mmBtu
x	Gas consumption	33 mmBtu per short ton
=	Gas cost	$198 per short ton
+	other production costs	$20 per ton
=	Total Cash Cost	$218 per ton

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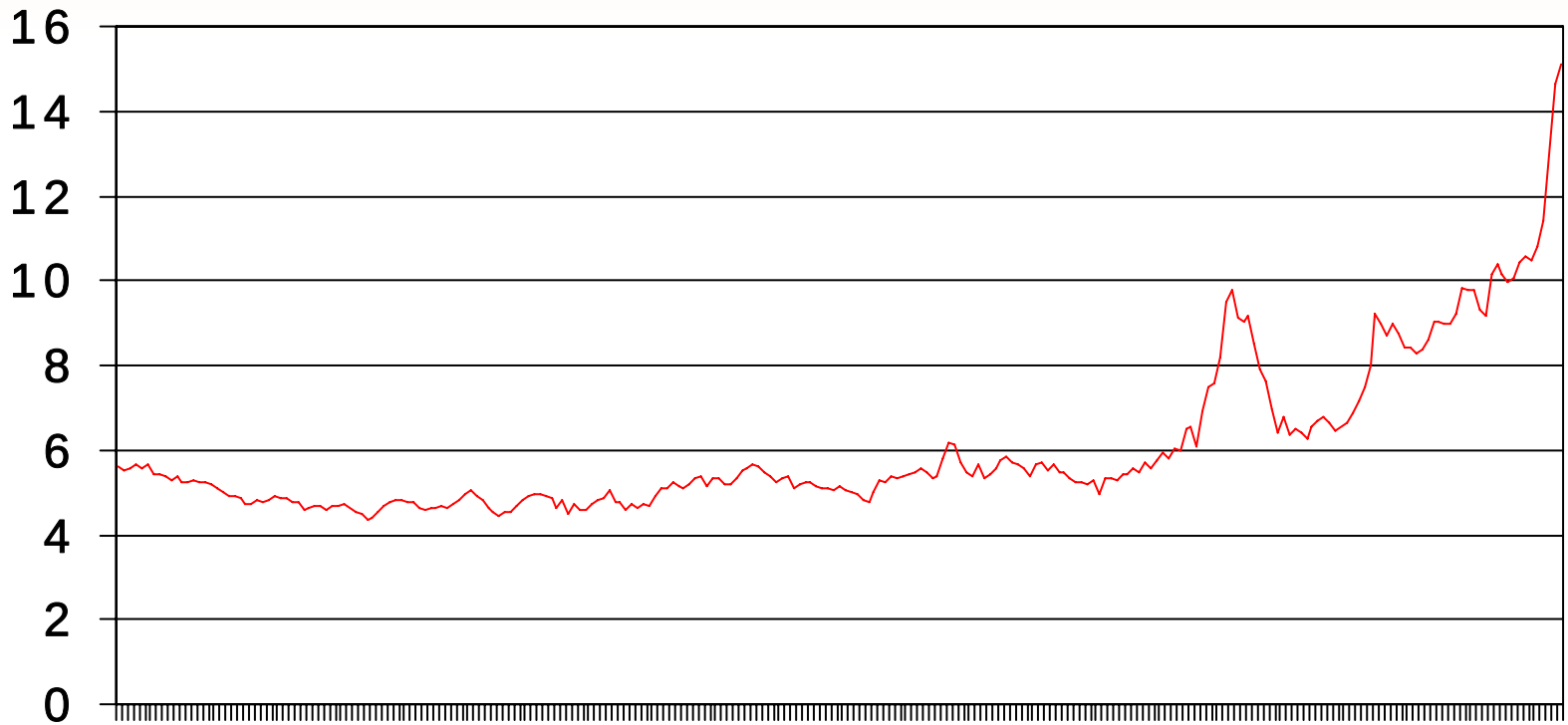
Natural Gas Cost Since 1985



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Nitrogen Fertilizer Market

- Global market
- Ammonia and urea are imported into the US
- US Production is in decline primarily due to low cost gas overseas
- Due to infrastructure limitations (pipelines, rail cars), domestic plants continue to operate when the demand (and price) support it.
- US Demand is set by acres of corn (primarily) and wheat (to a lesser extent).

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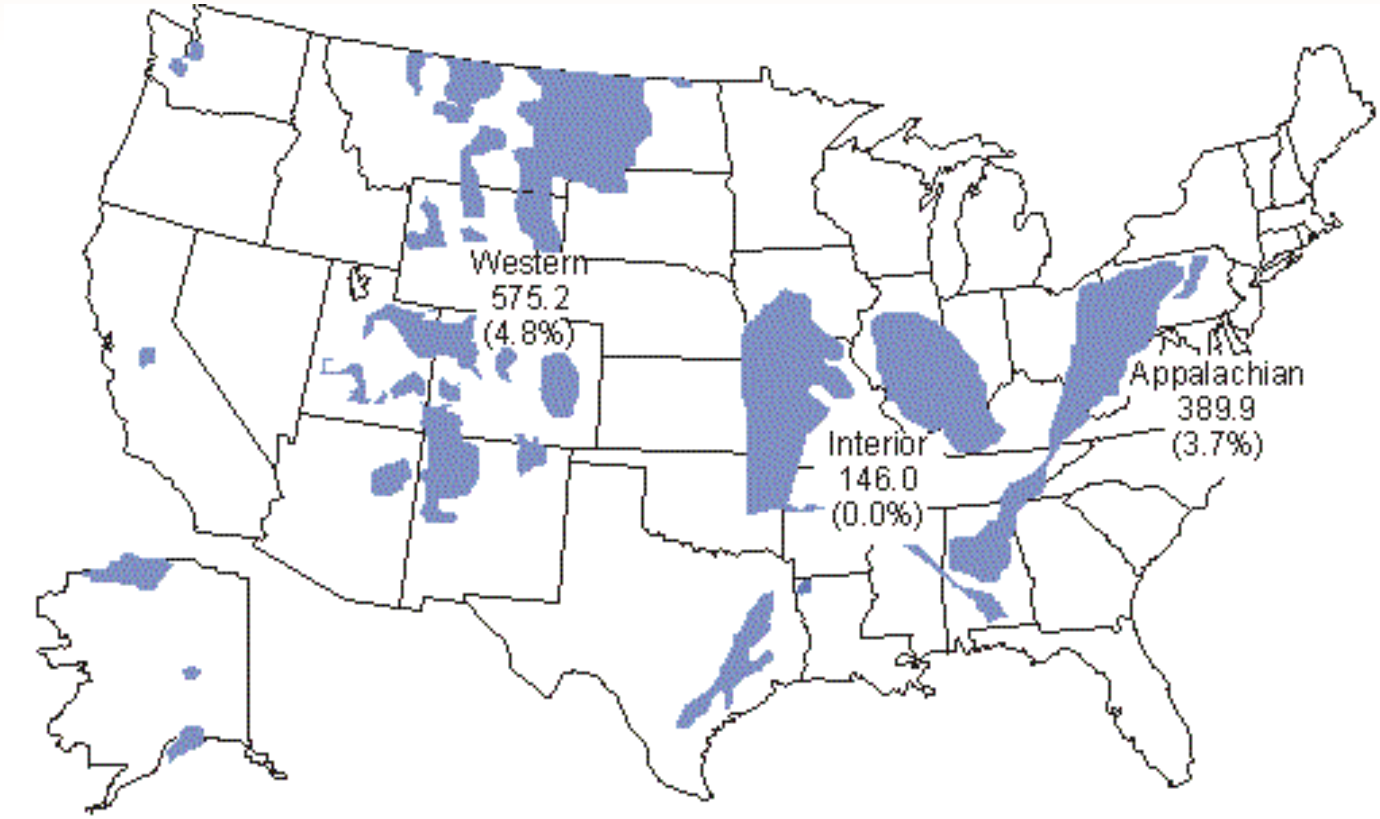
US Coal Reserves



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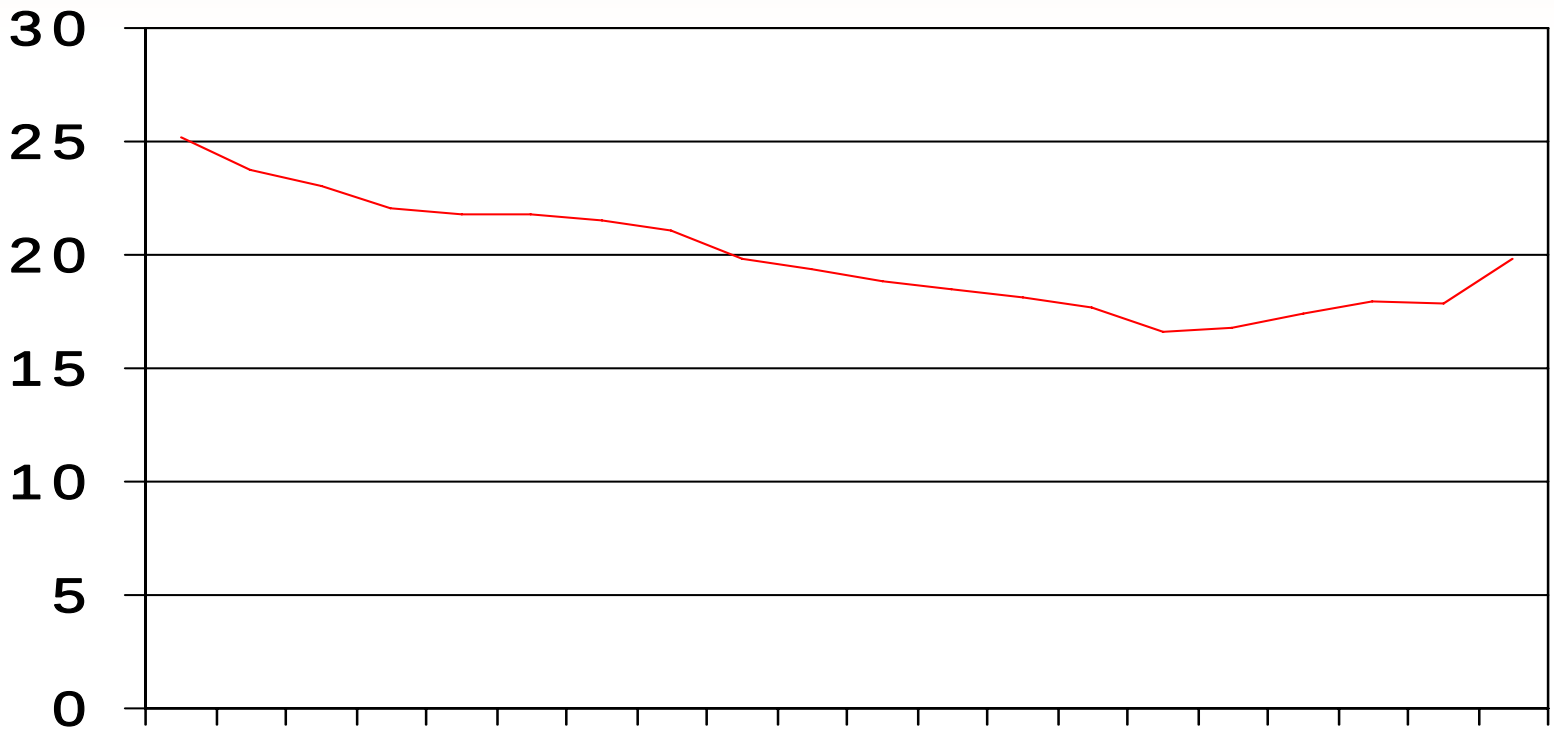
US Coal Prices 1985-2004



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Coal or Coke to Ammonia

Ammonia cash cost build-up (example)

Coke or coal	1.1 tons per ton
x Delivered cost	$30 per ton coke
Raw material cost	$33 per ton

Electricity	1,250 kwh per ton
x Electricity cost	$0.05 per kwh
Total electricity	$62.27 per ton

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Coal or Coke to Ammonia

Ammonia cash cost build-up (example)

Raw material cost	$33 per ton
Total electricity	$62.27 per ton
Other direct costs	$70 per ton
Debt (SWAG)	$50 per ton
Total cost	$215.27 per ton

Equivalent of $5.90 per mmBTU natural gas

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The future looks bright for Gasification!