

FROM OIL SAND TO FUEL PUMP

The Challenges of Upgrading Oil
Sand Bitumen

Vincent J Memmott

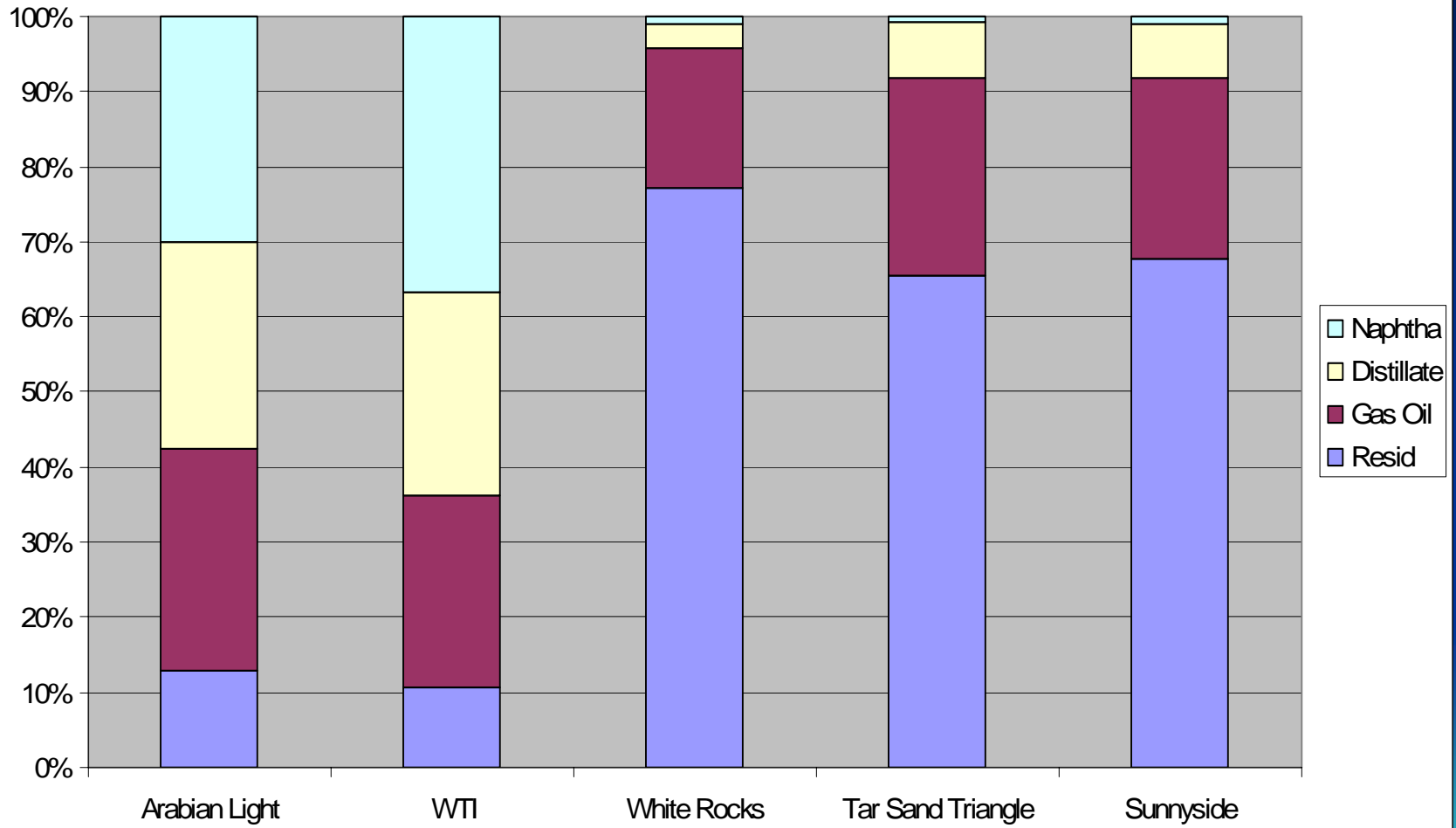


Oil Sands Development

Develop a resource that has market value.



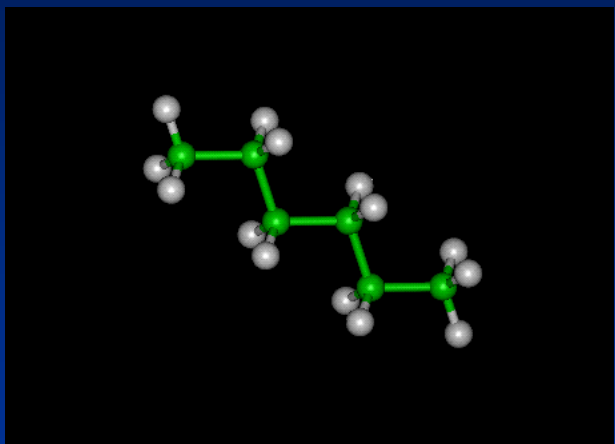
Crude vs. Bitumen



Crude vs. Bitumen Properties

	Arabian Light	WTI	White Rocks	Tar Sand Triangle	Sunnyside	Alberta
API Gravity	34.4	39.6	10.3	8.6	5.5	10
Sulfur, wt. %	1.69	0.333	0.4	4	0.6	4.7
Nitrogen, wt. %	0.07	0.073	1.3	0.4	0.7	0.5

Chemical Structure

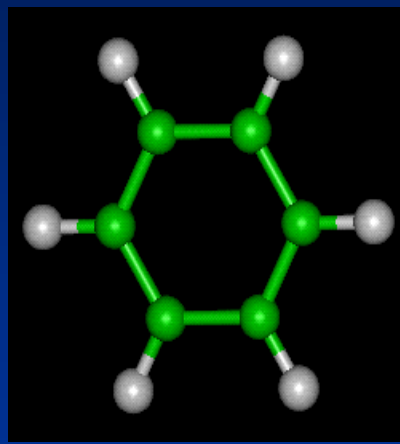


Hexane

6 Carbon

14 Hydrogen

H/C = 2.33

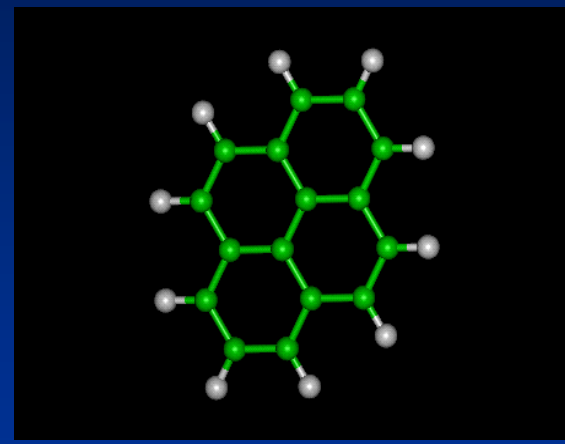


Benzene

6 Carbon

6 Hydrogen

H/C = 1.0



Pyrene

16 Carbon

10 Hydrogen

H/C = .63

Add Hydrogen or Remove Carbon

	Arabian Light	WTI	White Rocks	Tar Sand Triangle	Sunnyside	Alberta
H/C Atomic Ratio	1.82	1.89	1.61	1.47	1.56	1.49

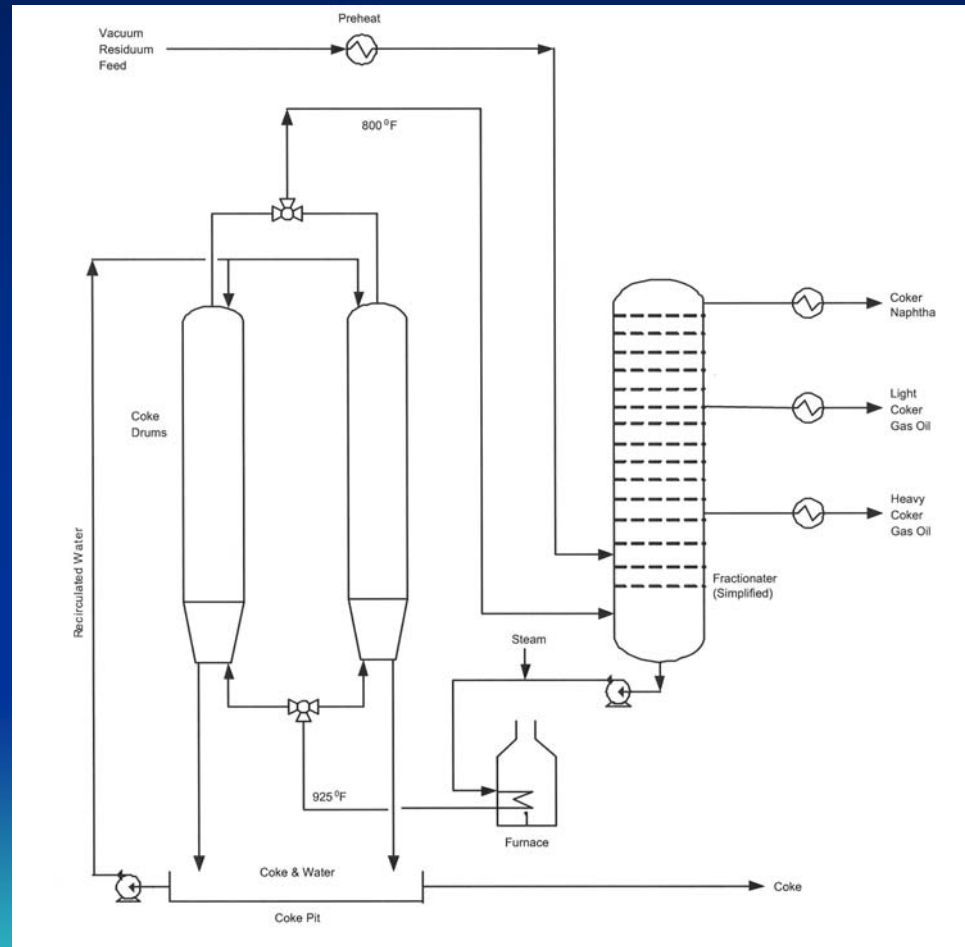


Proven Technologies

- Carbon Removal
 - Delayed Coking
 - Fluid Coking
- Hydrogen Addition
 - Fixed Bed Hydrotreating
 - Ebullated Bed Hydrotreating



Coking

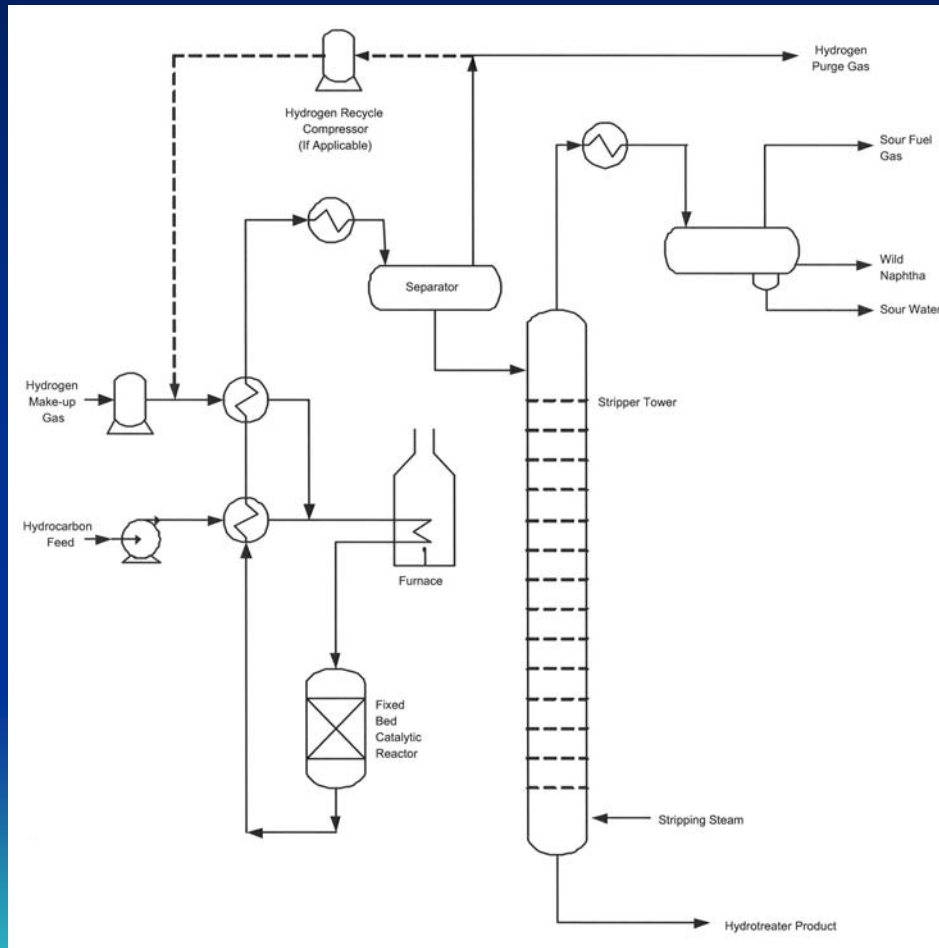


Energy Utilization

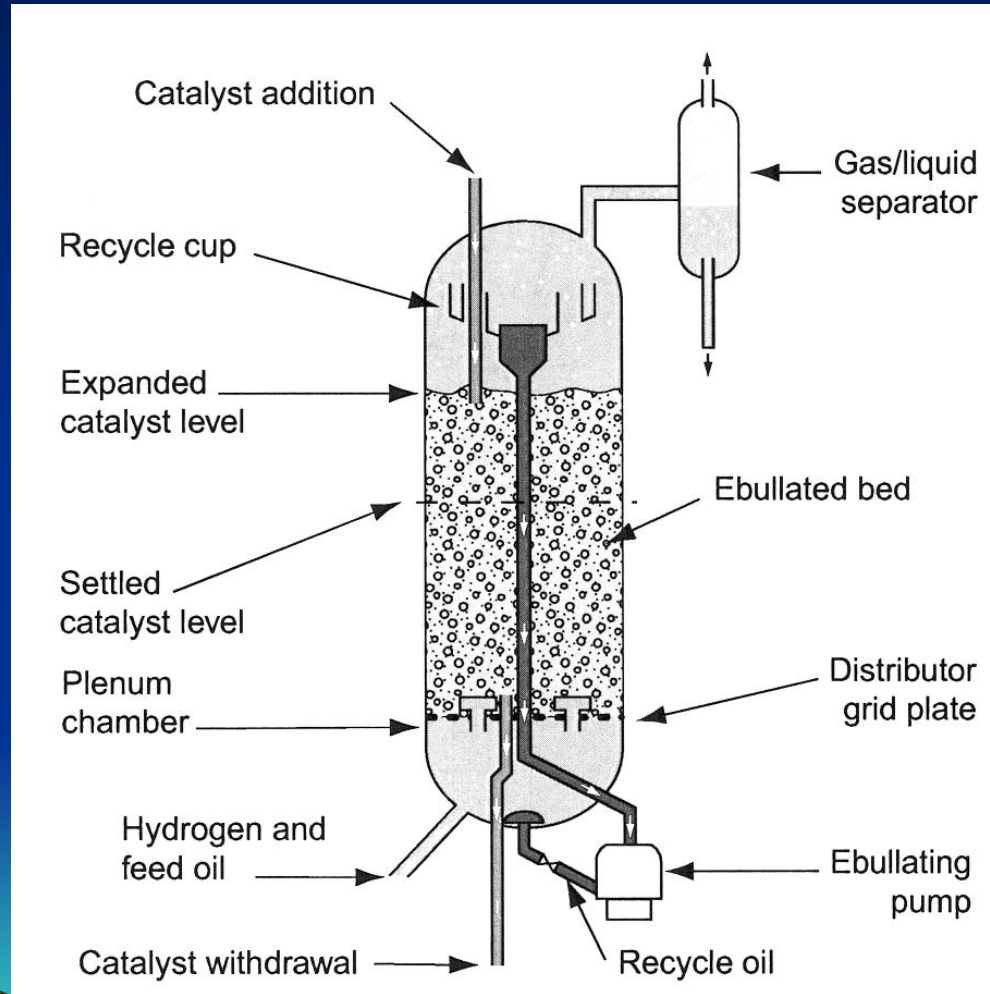
- Roughly 67% of the energy in Carbon
- 15% to 20% of Carbon is removed during coking
- 10% to 13% of the net energy in bitumen is lost to coke



Hydrotreating



Ebullated Bed



Hydrogen Economy

- Natural Gas insufficient to match growth
- Push upgrading to refineries
- Find other sources of Hydrogen



Upgrade Strategy

- Completely upgrade at site?
- Partial upgrade at site?
- Upgrade at refineries?



Alberta Exports

- Syncrude
- Synbit
- Dilbit



Learning from Canada

- Government Support
- Economy of Scale
- Produced Syncrude to Create Market
- Pipeline to Markets
- Raw bitumen needs diluent
- Persuaded Market Refiners to Upgrade
- Helped Capitalize Some Refinery Projects



Clean Slate Project

- Economy of Scale
- Some Level of Upgrading
 - Coking
 - Hydrotreating
- Gasification
- Aggressive Market Development



Market

- Rocky Mountain Refineries
 - Utah – 170,000 B/D
 - Wyoming – 160,000 B/D
 - Colorado – 100,000 B/D
 - Montana – 190,000 B/D
- Pipeline to Casper
- Pipeline to Bakersfield



Upgrading is Essential



©1997 Jeff Buschman

Questions

