



# FTCrude® Bitumen & Heavy Oil Upgrader Technology Presentation

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**EXPANDER ENERGY INC.**  
INNOVATIVE ENERGY SOLUTIONS

# LEGAL DISCLAIMER



This presentation contains **forward looking statements** based on management's assessments of future plans that involve engineering, operational and financial estimates of future production, capital expenditures, cash-flow and earnings. A number of risks and uncertainties that may or may not be within control of the company and may cause these results to vary materially from those predicated herein and the reader is therefore cautioned that such information is speculative in nature.

# INTRODUCTION



1. Introduction **FTCrude®** “Fischer-Tropsch **Crude**” Concept developed by Expander Energy Inc., Calgary.
2. Review **FTCrude®** Process Applications;
  - **FTCrude®** Partial Upgrader to produce PUB
  - **FTCrude®** Full Upgrader to produce Sweet SCO
  - **FTCrude®** Refinery to produce Gasoline, Diesel and Jet Fuel
3. Basic **FTCrude®** Economics
4. Proposed Alberta/Canadian Clean OilSands Integrated Solution Opportunities

# FTCrude® DEVELOPMENT



- Project Development for 8 years
- PreFeed Studies completed for several applications in Partial Upgrading, Full Upgrading and Refining
- Multiple Patents issued worldwide and a number of patents pending – **CDN Patent # 2,737,872**
- FTCrude® Licensing and/or Equity JV partnering available from Expander Energy Inc. of Calgary

# Process Highlights of FTCrude®



- **100% CONVERSION** of Bitumen, Heavy Oil & Refinery Bottoms
- **NO WASTEFUL BY-PRODUCTS** such as Asphalt, Petcoke, Unconverted Residue, or heavy fuel oil
- **>130 vol% product yield** of High Value, High Cetane (>50) Synthetic Diesel
- **>90+% Carbon Efficiency**
- **>50% CO<sub>2</sub> (GHG) emission reduction/ BBL product**

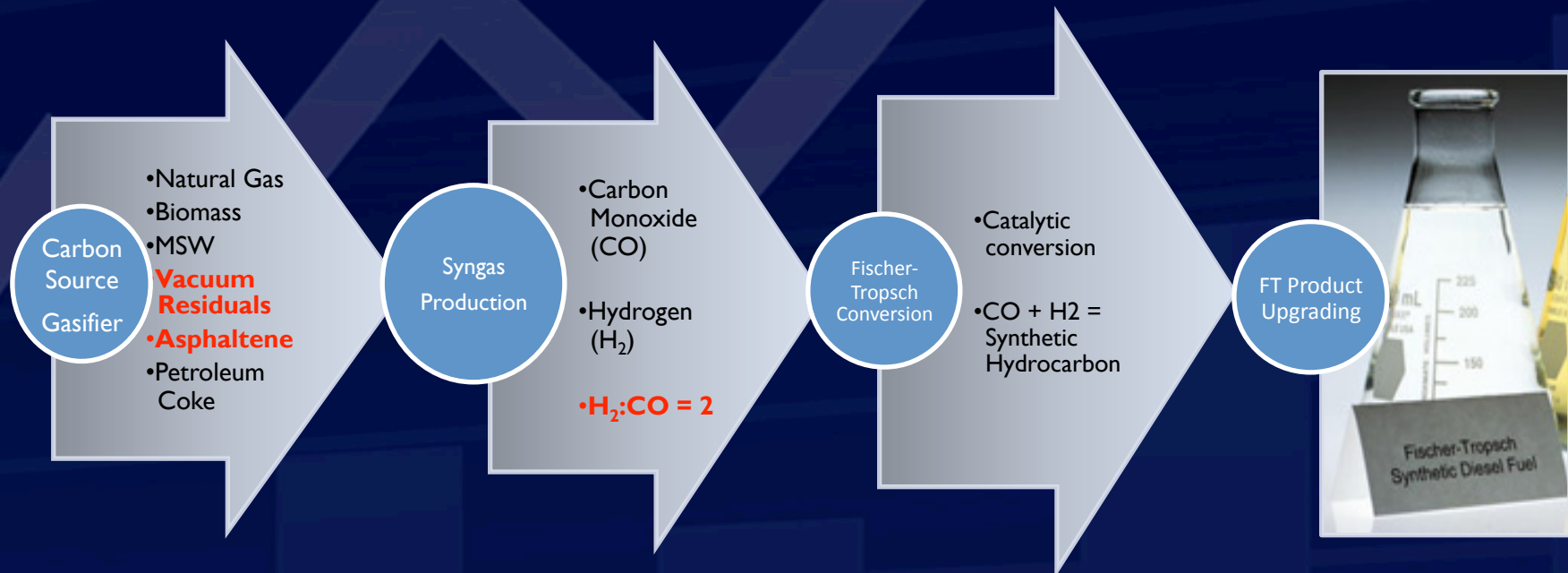
# Commercial Highlights of FTCrude®



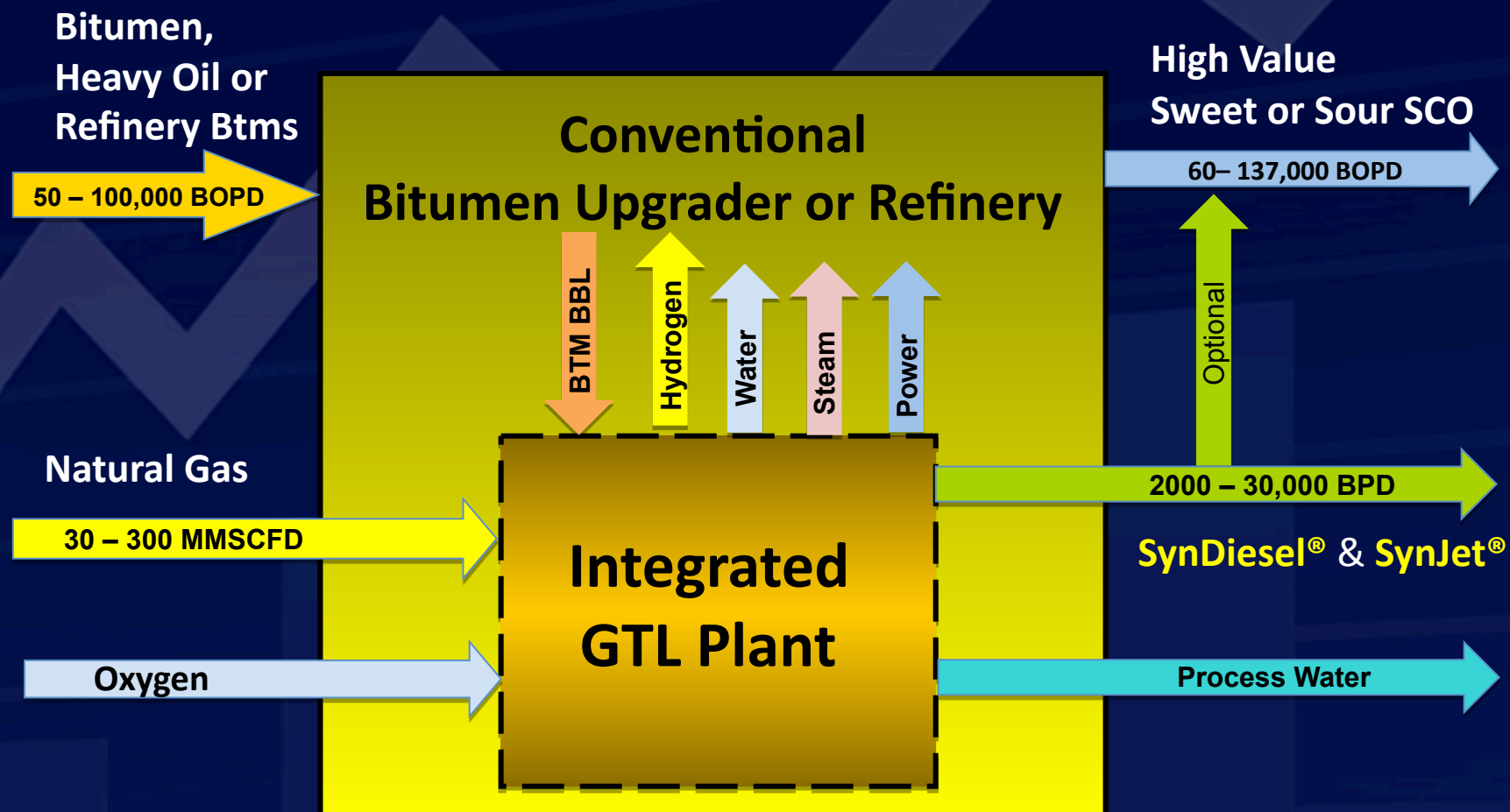
- **Commercially Proven, Licensable and Guaranteed Process Concept**
- Capital Cost projected TIC <\$70,000/BPD SCO for full upgrading
- High Reliability as SMR used to generate Hydrogen – reliability DOES NOT depend on low reliability gasifier
- **Typical Project IRR greater than 20%**
- Low sensitivity to natural gas pricing based on long term oil price projections
- Significant CAPEX & OPEX savings in Hydroprocessing units as units are less capacity and use Fixed Bed HCU technology



# Fischer-Tropsch Process



# Expander FTCrude® Technology Concept





# SynDiesel® Fuel Specifications

**Cetane = 100 for Base**, Premium Biodiesel = 60, Alberta SCO = 32, N.America Std = 40, European Std = 50 min

ASTM D 975 Requirements for Diesel Fuel Oils

Property	Test Method*	Low Sulfur No. 1-D	No. 1-D	Low Sulfur No. 2-D	No. 2-D	No. 4-D
Flash point, °C, min	D 93	38	38	52	52	55
Water and sediment, % vol, max	D 2709 D 1796	0.05	0.05	0.05	0.05	0.50
Distillation temperature, °C, 90% vol recovered	D 86					
min				282	282	
max		288	288	338	338	
Kinematic viscosity, 40°C, cSt	D 445					
min		1.3	1.3	1.9	1.9	5.5
max		2.4	2.4	4.1	4.1	24.0
Ash, % mass, max	D 482	0.01	0.01	0.01	0.01	0.1
Sulfur, % mass, max	D 2622	0.05	0.50	0.05	0.50	2.00
Copper strip corrosion, 3 hr at 50°C, max rating	D 130	No. 3	No. 3	No. 3	No. 3	
Cetane number, min	D 613	40	40	40	40	30
One of the following:						
1) Cetane index, min	D 976	40		40		
2) Aromaticity, % vol, max	D 1319	35		35		
Ramsbottom carbon residue on 10% distillation residue, % mass, max	D 524	0.15	0.15	0.35	0.35	

\* All "Dxx" methods are ASTM standards.

60C 354C

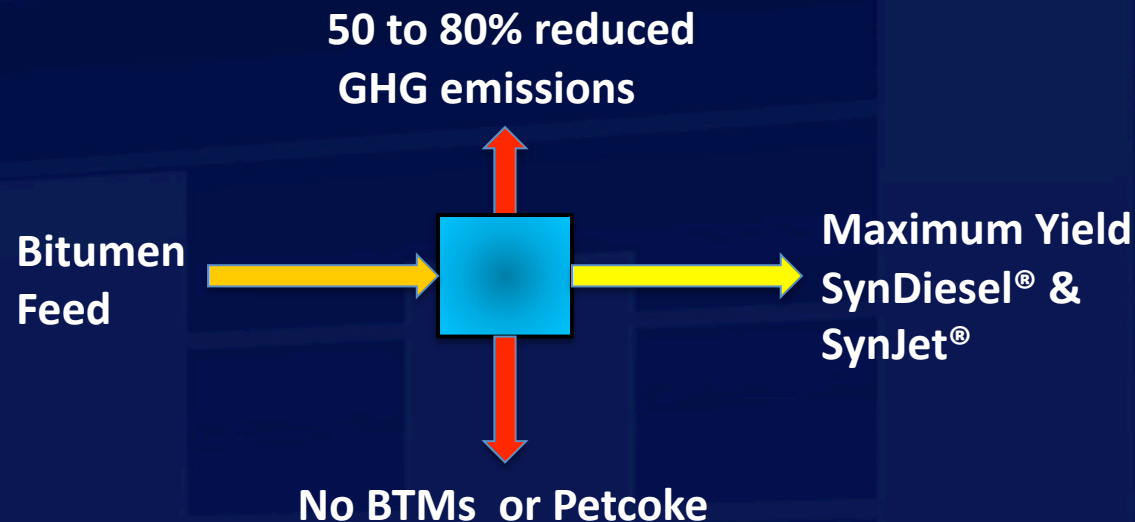
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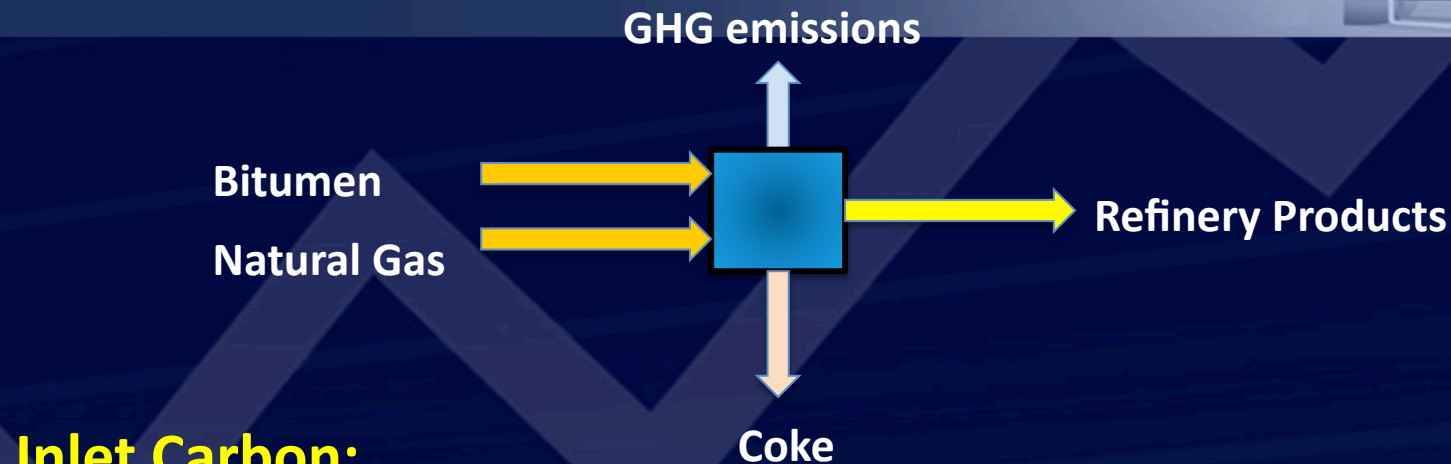
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# Carbon Management Story

- ✓ Conversion of Low Value Carbon supply to High Value Carbon product – **SynDiesel® & SynJet®**
- ✓ Maximum Retention of Carbon
- ✓ Maximum Conversion of Carbon
- ✓ Minimum Carbon Rejection – low GHG Emissions



# Carbon Efficiency – COKER Process



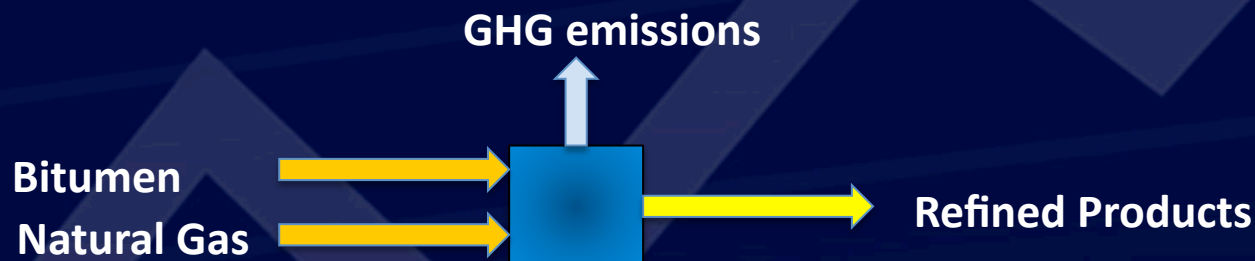
## Inlet Carbon:

Bitumen	50,000 BPD	→	6,806 TPD C
Total Natural Gas	47 MMSCFD	→	713 TPD C

## Outlet Carbon:

Total CO <sub>2</sub> Emissions	2,610 TPD X 0.27	→	705 TPD C
Pet Coke	1,707 X 0.89	→	1,518 TPD C

# Carbon Efficiency – FTCrude<sup>®</sup> Process



## Inlet Carbon:

Bitumen  
CARBON

50,000 BPD



6,806 TPD

Total Natural Gas

109 MMSCFD



1,653 TPD CARBON

## Outlet Carbon :

Total CO<sub>2</sub> Emissions

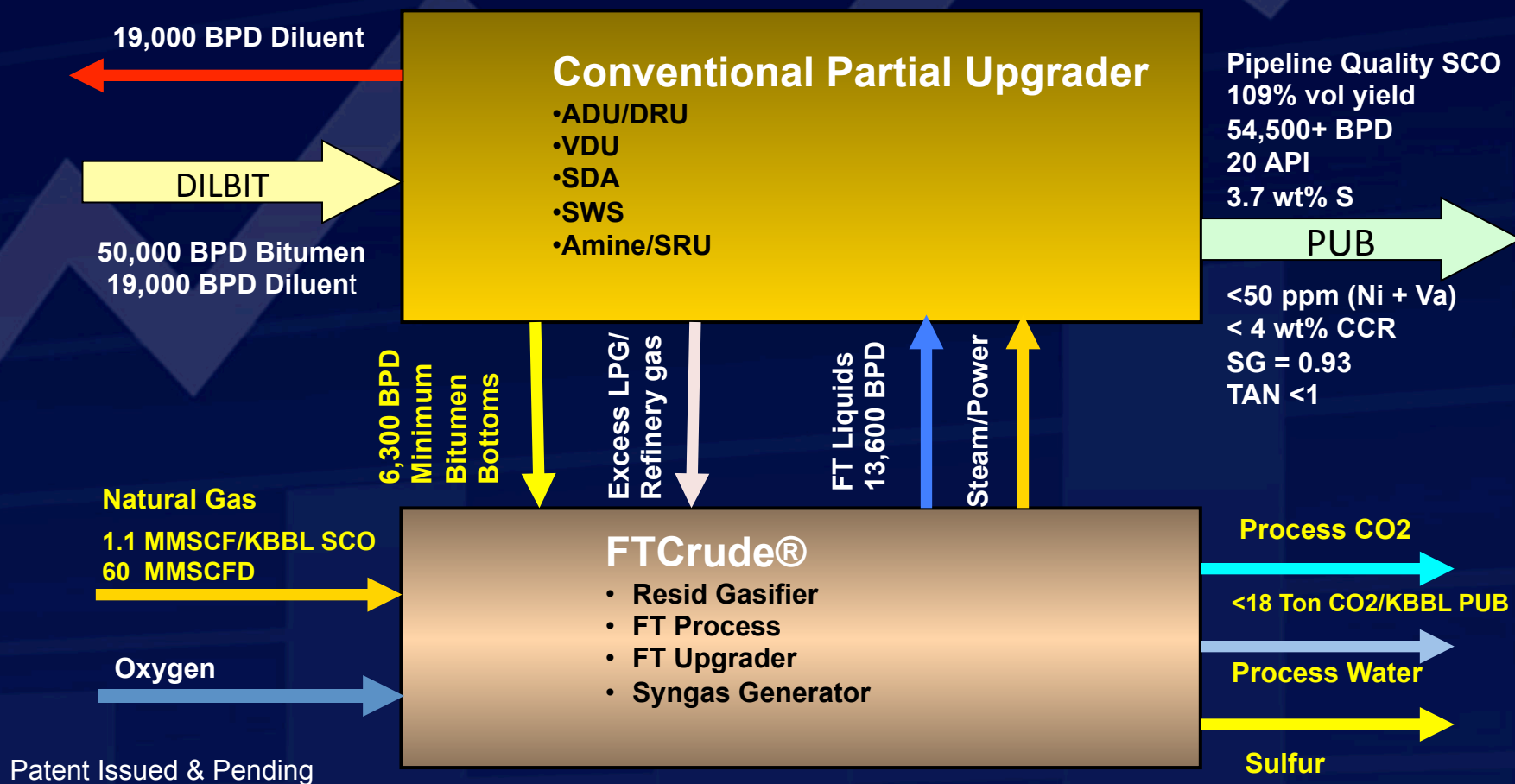
1,975 TPD X 0.27



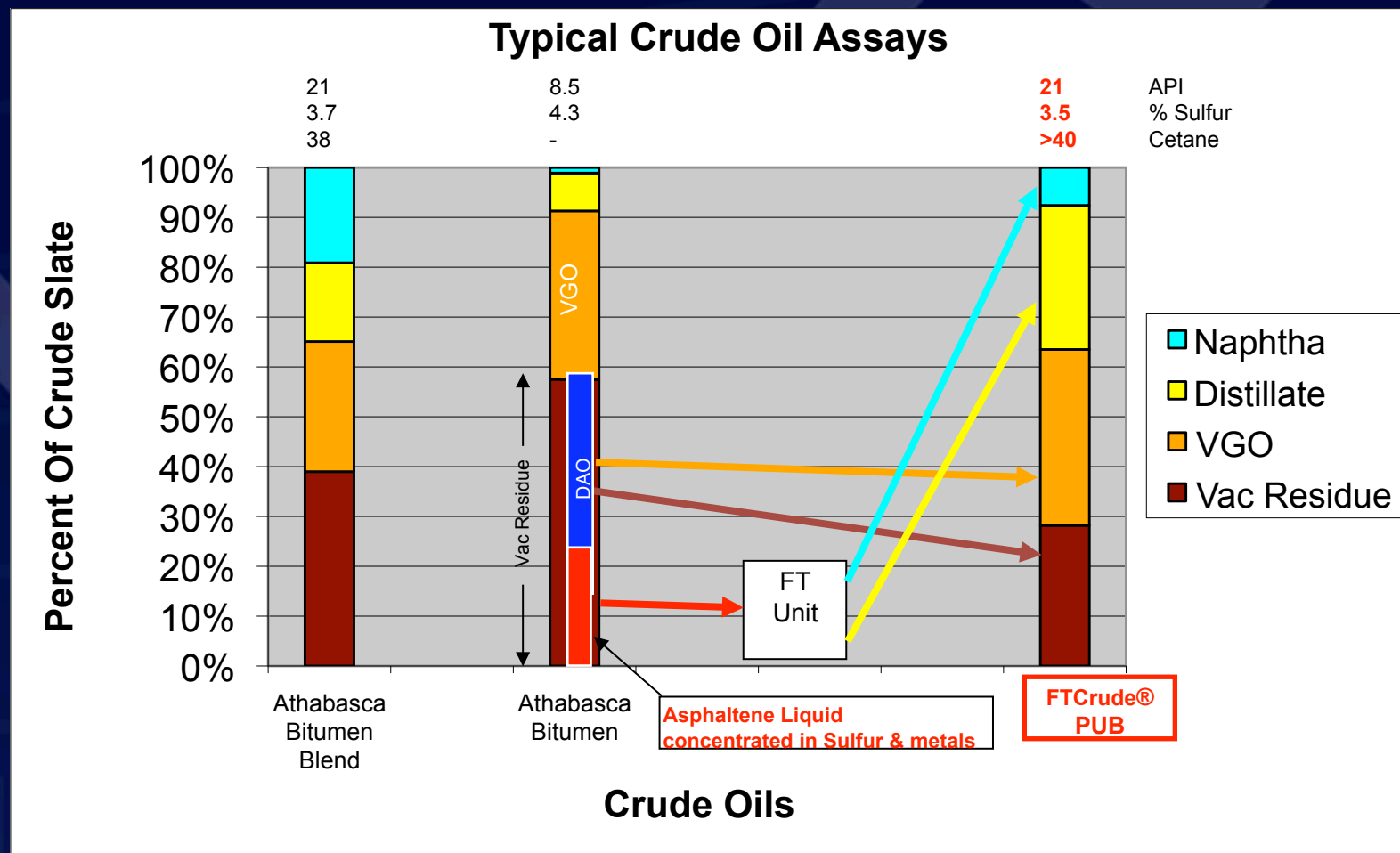
529 TPD CARBON

# Expander FTCrude® Partial Upgrader (PUB)

**Partial Upgrader – No Diluent Required, Asphaltene removed from SCO**

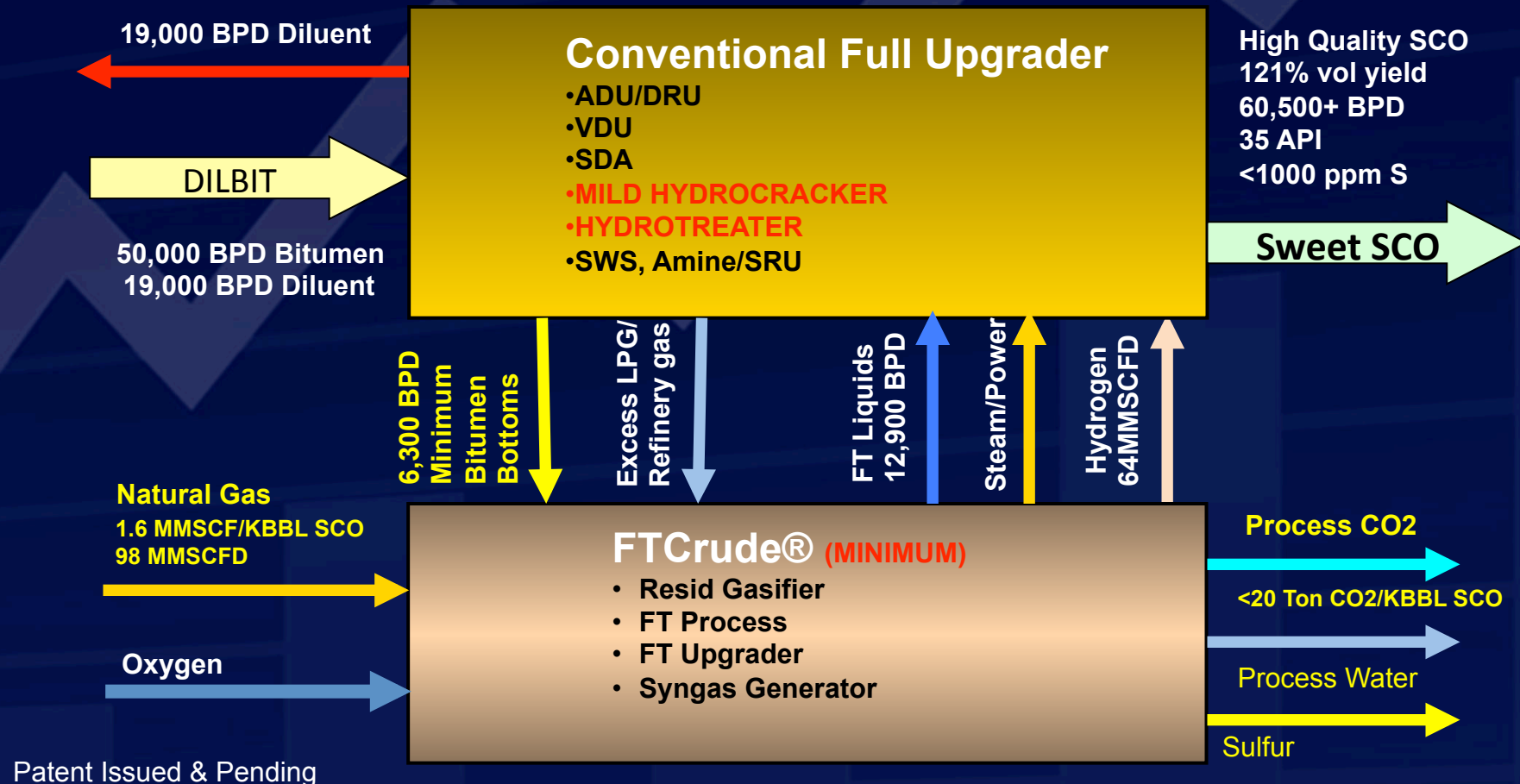


# Expander FTCrude® Partial Upgrader (PUB)



# Expander FTCrude® Full Upgrader (SCO)

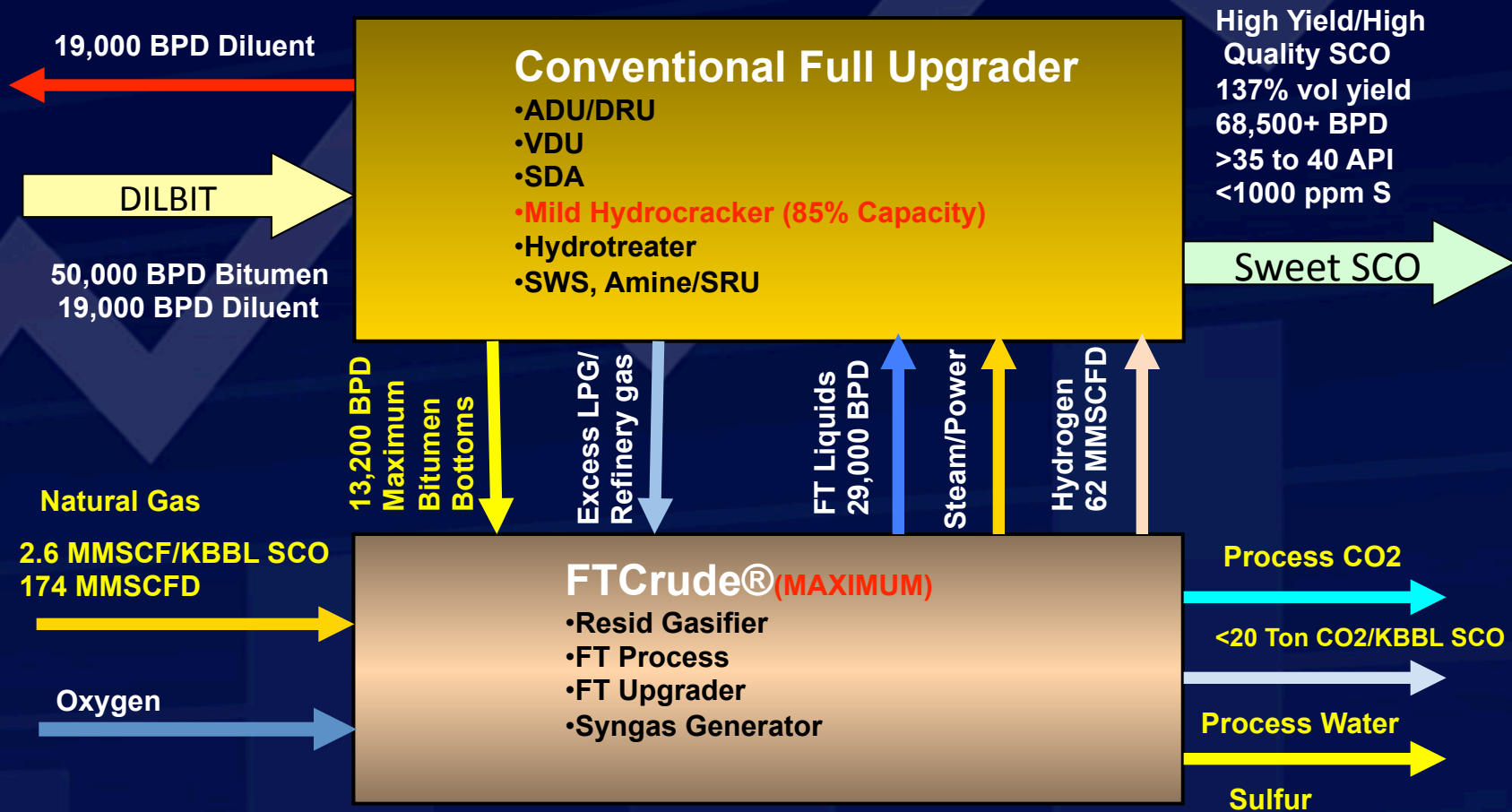
Full Upgrader – 35+ API Sweet SCO or SynDiesel/SynJet sold separately





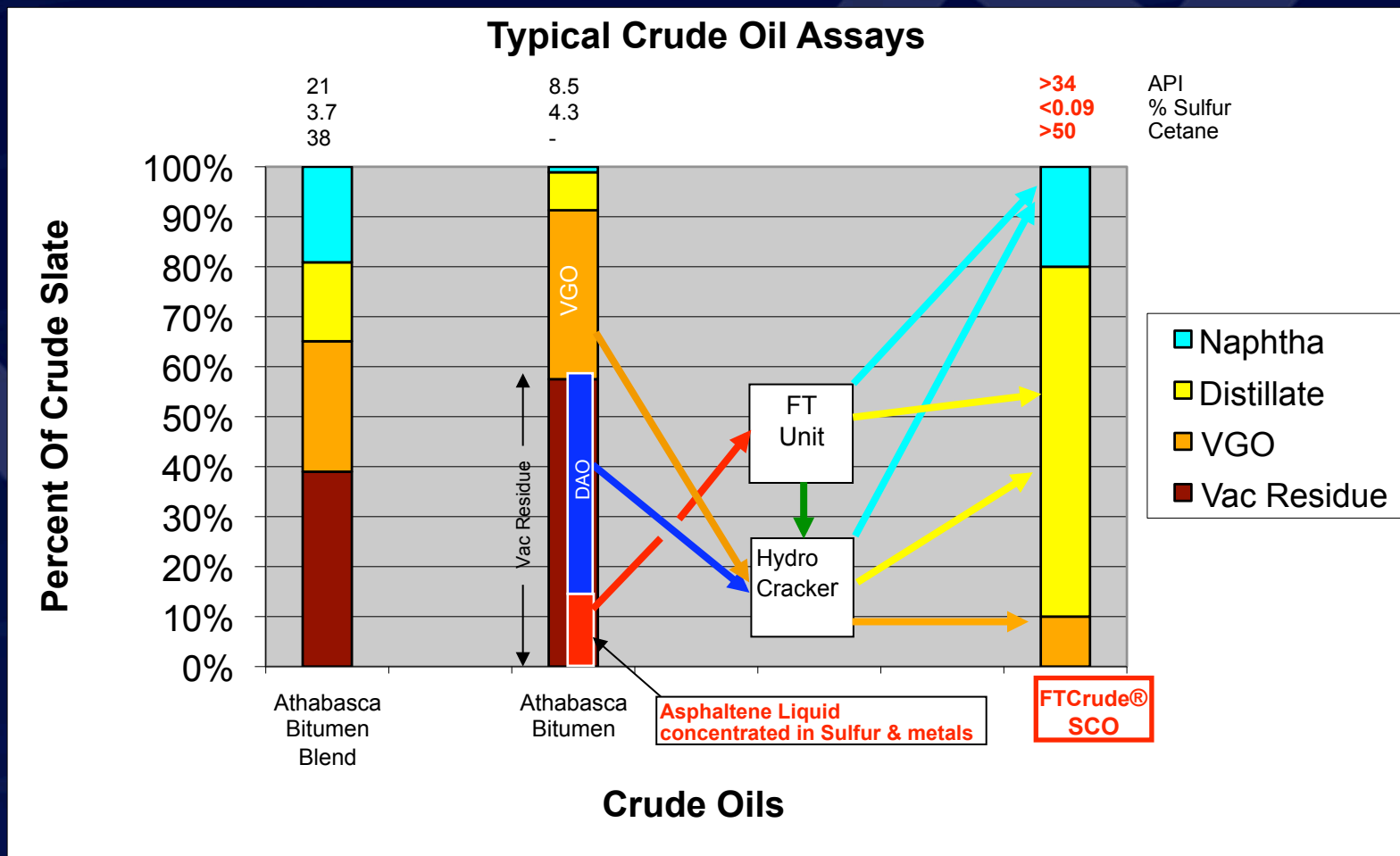
# Expander FTCrude® Full Upgrader (SCO)

## Maximum Yield Full Upgrader Design



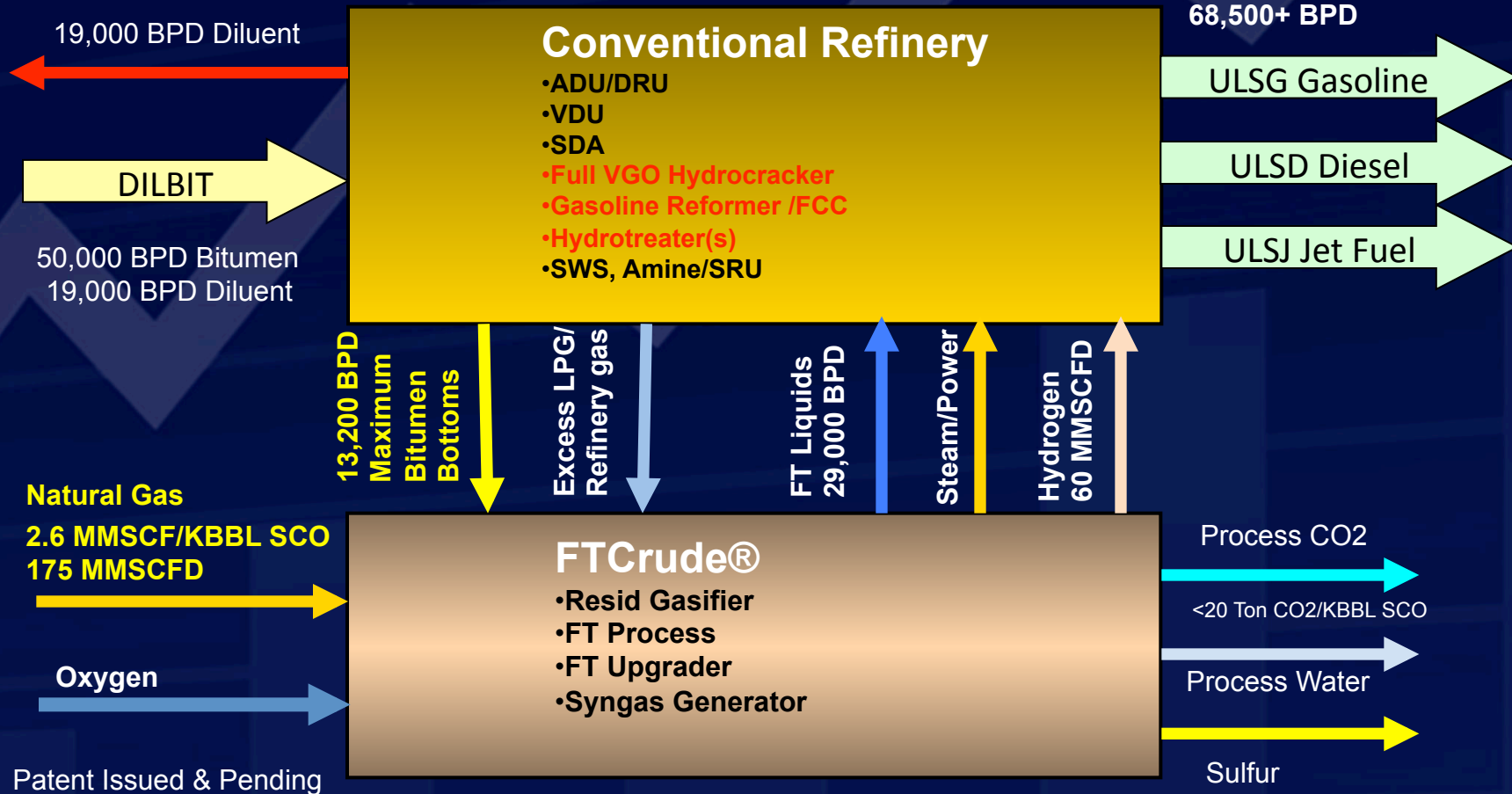
Patent Issued & Pending

# Expander FTCrude® Full Upgrader (SCO)

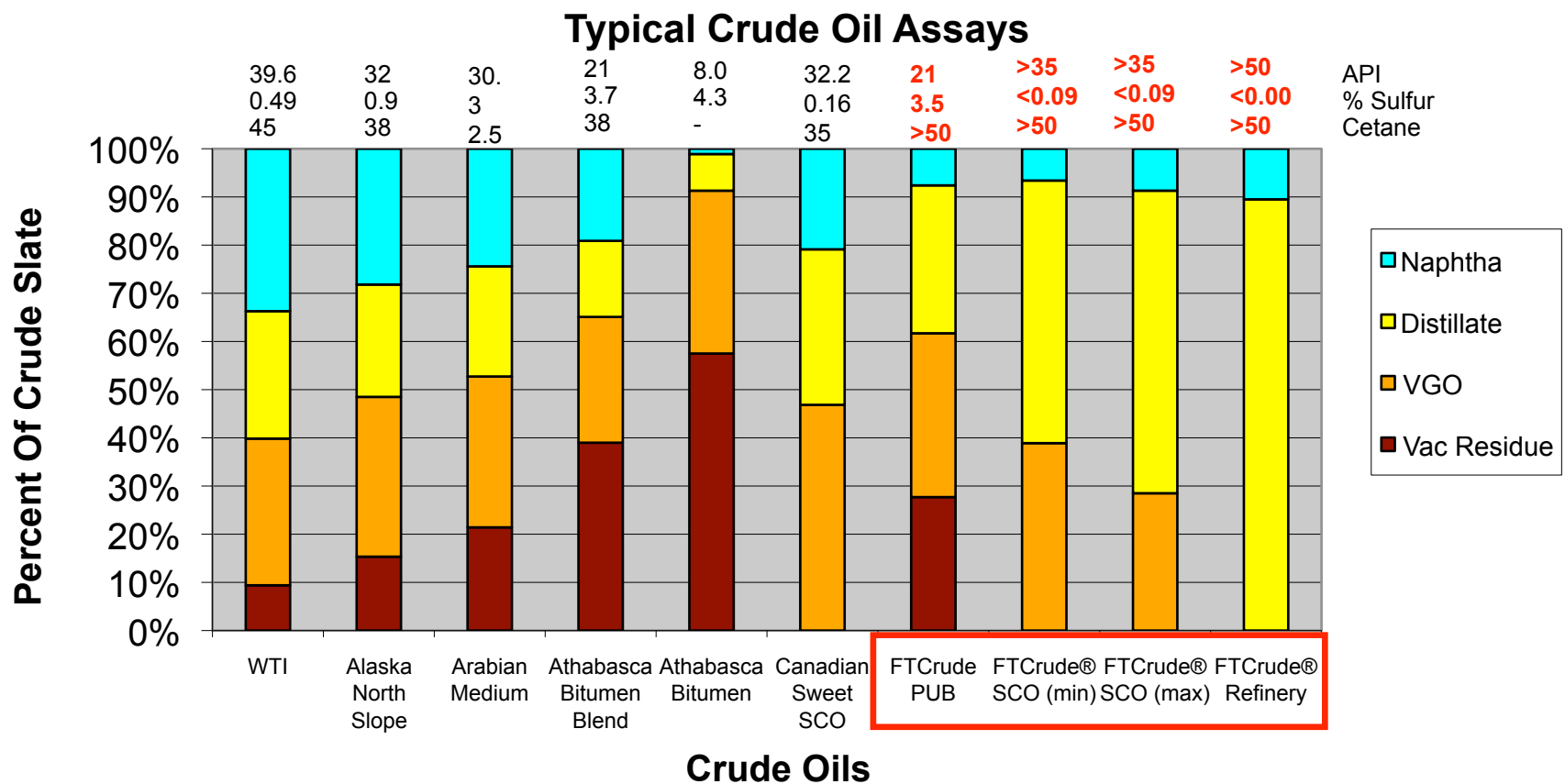


# Expander FTCrude® Refinery

## Maximum Yield Refinery Design



# Comparison of Expander FTCrude® Products



# Delayed Coker Basic Economics



**Est Capex for 50,000 BPD Coker Based Upgrader =  
\$3,300 M total over 2 years**

## Revenues

- Coker Based SCO Sales       $41,000 \text{ BPD} \times \$100/\text{BBL} \times 347 \text{ day/year}$       = \$1,423 M/yr

## Estimated Operating Cost

- Bitumen Feed Cost       $50,000 \text{ BPD} \times \$50/\text{BBL} \times 347 \text{ day/year}$       = \$868 M/yr
- Natural Gas Requirement       $47 \text{ MMSCFD} \times \$4/\text{MSCF} \times 347 \text{ day/year}$       = \$65 M/yr
- Additional Fixed Opex       $4\% \times \text{Capex}$       = \$132 M/yr

**Net BT Revenue**      **= \$358 M/yr**

**Est BT IRR = 10%      Est NPV@15% = <\$1,041 M>**

Note 1: Light/Heavy Differential = \$SCO (\$WTI +\$10) – (\$WCS) = \$90 + \$10 - \$70 = \$30/BBL

Note 2: Cost of Diluent Use = Cost Diluent + Handling – Cost Recovery = \$20 per BBL Bitumen

# FTCrude® Partial Upgrader Basic Economics

**Est Capex for 50,000 BPD FTCrude® Partial Upgrader  
= \$1,600 M total over 2 years**

## Revenues

- FTCrude® PUB Sales      54,500 BPD X \$75/BBL X 347 day/year      = \$1,418 M/yr

## Estimated Operating Cost

- Bitumen Feed Cost      50,000 BPD X \$50/BBL X 347 day/year      = \$868 M/yr
- Oxygen Supply      1050 TPD X \$50/Tonne X 347 day/year      = \$18 M/yr
- Natural Gas Requirement      60 MMSCFD X \$4/MSCF X 347 day/year      = \$83 M/yr
- Additional Fixed Opex      4% X Capex      = \$64 M/yr

## Net BT Revenue

**= \$385 M/yr**

**Est BT IRR = 22%**

**Est NPV@15% = \$703 M**

Note 1: PUB Value= \$WCS +\$5= \$75 per BBL

Note 2: Cost of Diluent Use = Cost Diluent + Handling – Cost Recovery = \$20 per BBL Bitumen

# FTCrude® Full Upgrader Basic Economics

**Est Capex for 50,000 BPD FTCrude® Upgrader  
= \$4,000 M total over 2 years**

## Revenues

- FTCrude® SCO Sales      60,500 BPD X \$100/BBL X 347 day/year      = \$2,099 M/yr

## Estimated Operating Cost

- Bitumen Feed Cost      50,000 BPD X \$50/BBL X 347 day/year      = \$868 M/yr
- Oxygen Supply      1050 TPD X \$50/Tonne X 347 day/year      = \$18 M/yr
- Natural Gas Requirement      98 MMSCFD X \$4/MSCF X 347 day/year      = \$136 M/yr
- Additional Fixed Opex      4% X Capex      = \$160 M/yr

## Net BT Revenue

**= \$917 M/yr**

**Est BT IRR = 21%**

**Est NPV@15% = \$1,496 M**

Note 1:

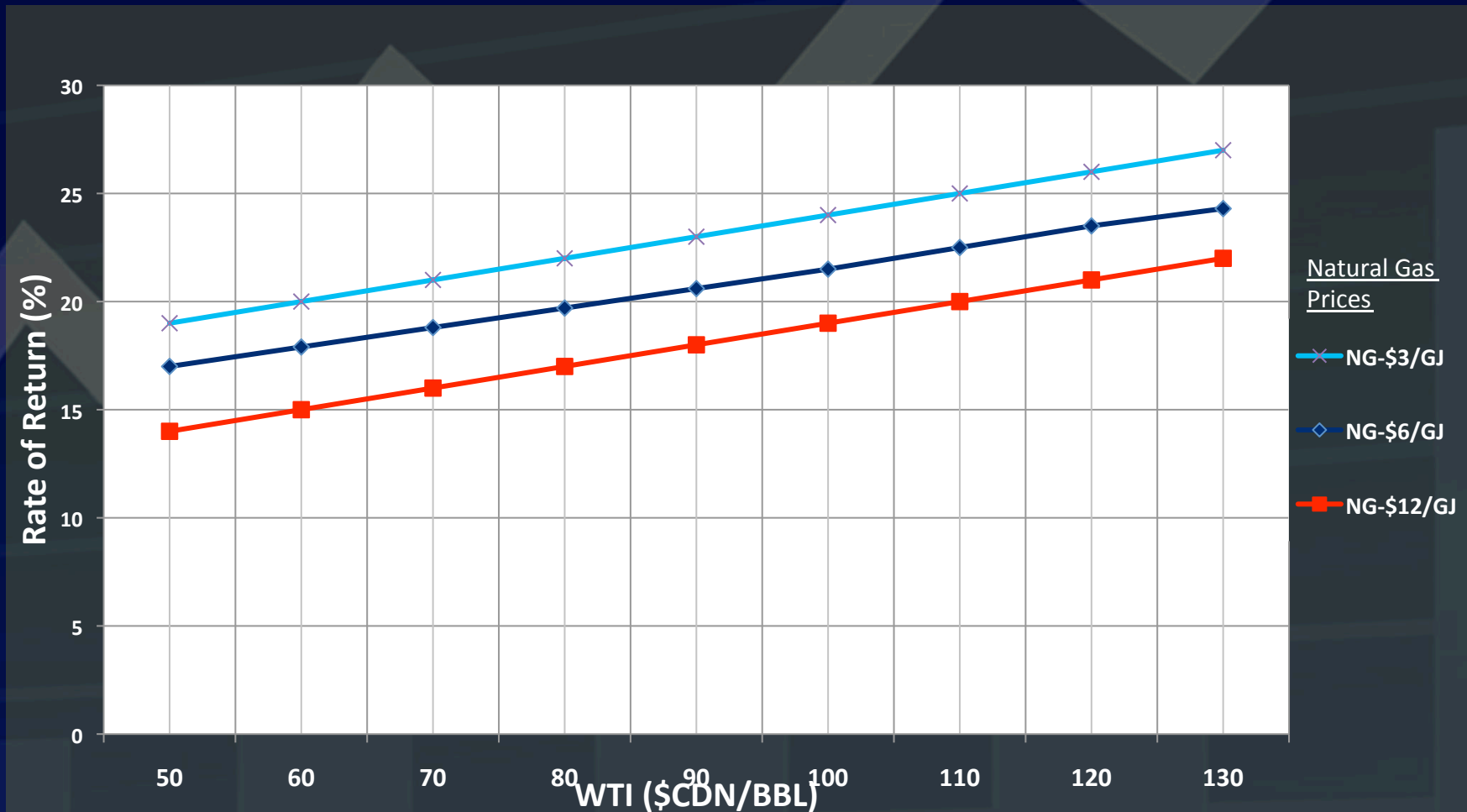
Light/Heavy Differential = \$SCO (\$WTI + \$10) – (\$WCS) = \$90 + \$10 - \$70 = \$30/BBL

Note 2:

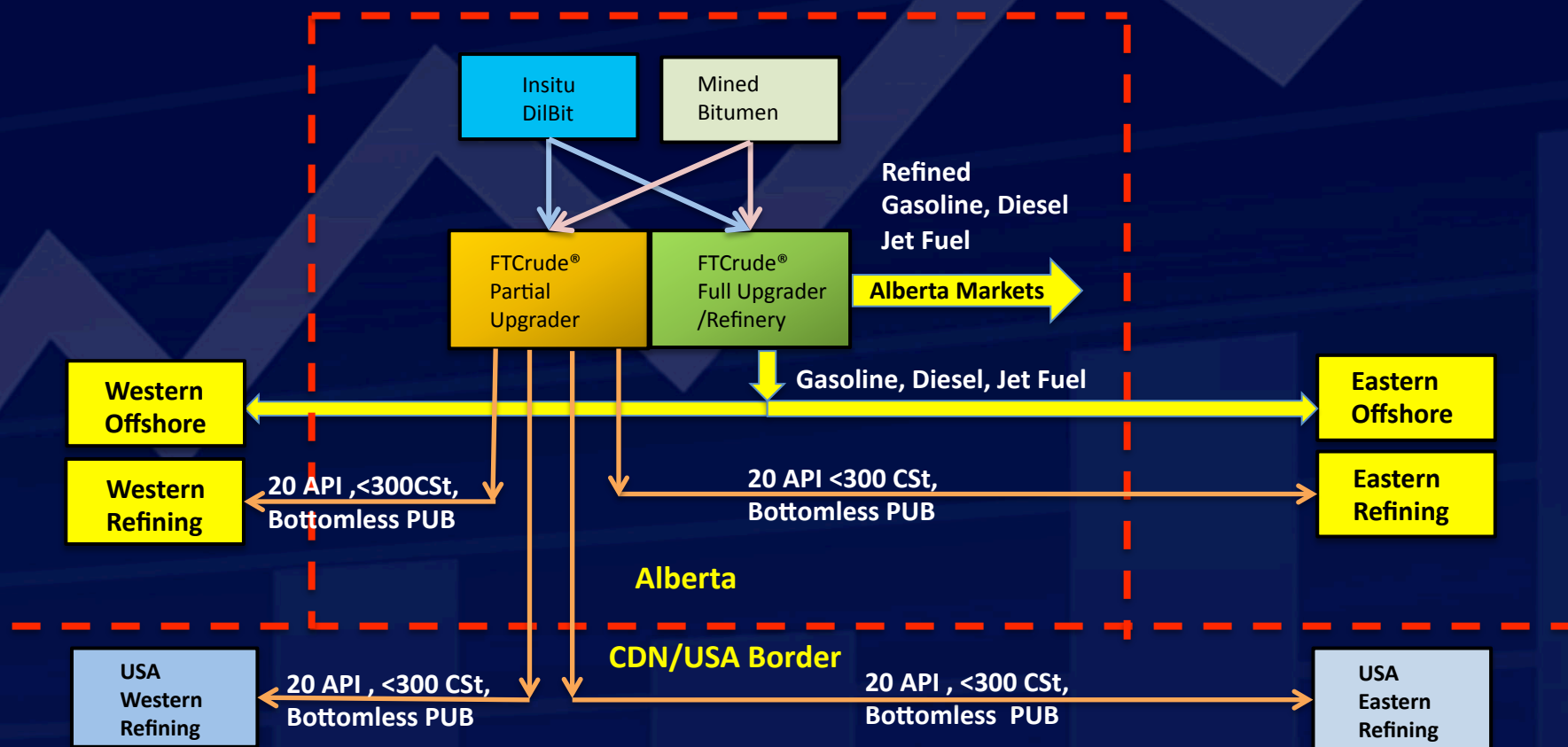
Cost of Diluent Use = Cost Diluent + Handling – Cost Recovery = \$20 per BBL Bitumen



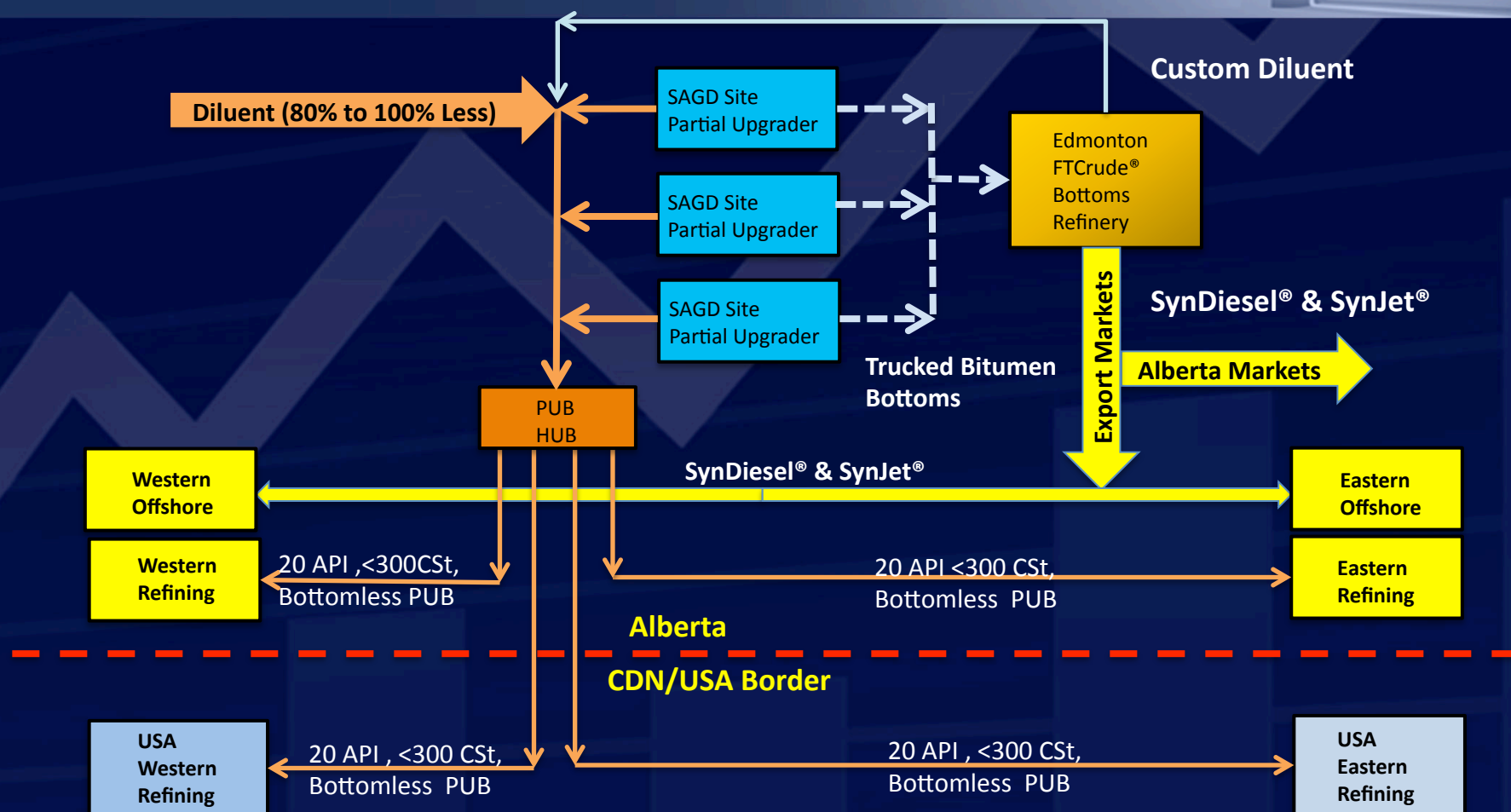
# FTCrude® Full Upgrader Economic Feasibility



# Alberta/Canadian Clean Oilsands Integrated Solution



# Alberta SMALL SAGD Integrated Solution



# THANK YOU - Contact Us

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