Challenges of Processing Canadian Crudes

Low Cost Reliable Operation in a Competitive Business Environment

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Joint CCQTA/COQA Meeting
Agenda

- **Phillips 66 Refining**
  - Background
  - Challenges

- **Canadian Crude Challenges**
  - Variability
  - Corrosion
  - Desalting
  - Fouling

- **Phillips 66 approach to Canadian crude processing**
Phillips 66 Refining

- 2.2 MMBD processed in 2011
- Full range of world crudes processed
- Well situated to process Canadian Crude
  - Pipeline Access
  - Existing cokers at Billings, Ponca City, & Wood River
  - New Cokers with Cenovus JV at Wood River and Borger
Characteristics of a “Terrible Industry”

- Undifferentiated commodity products
- Everyone has same costs
- No technology differentiation
- Knowledgeable, price sensitive buyers
- Buyers willing to switch suppliers

This describes Refining industry

Source: Good Strategy Bad Strategy© by Richard Rumelt
Refinery Challenges

- **Business environment**
  - Low margins
  - Tightening regulatory environment
  - Uncertain, rapidly changing crude supply

- **Opportunities**
  - Low cost feedstocks
  - Low maintenance and turnaround costs
  - High reliability
Evolving Mid Continent Crude Supply

Map showing locations such as Melaka PSR2, Lake Charles, Ferndale, Ponca City, Borger, Wood River, Bayway, Alliance, Sweeny, Lake Charles, Billings, Bakken, Canadian Heavy, Billings, Humber, Whitegate, MIRO, Rodeo, Santa Maria, Los Angeles, Borger, Alliance, Wood River, Bayway, Alliance, Sweeny, Lake Charles, Billings, Bakken, Canadian Heavy, Billings.
Challenge #1 – Crude Variability - Seasonal

Data with permission from crudemonitor.ca
Challenge #1 - Crude Variability – Change over time

Western Canadian Select - Sulfur

- Hardisty Terminal
- Linear (Hardisty Terminal)
- Fit to Hardisty Data

Data with permission from crudemonitor.ca
Challenge #1 – Crude Variability – Batch to Batch

Data with permission from crudemonitor.ca
Challenge #2 – Naphthenic Acid Corrosion

2008 Fouling & 2011 Corrosion

LCU Btms

Vac Htr

Vac Twr

HVGO PA

2009 Corrosion

2009 Fouling

Vac Resid

2009 Corrosion > 100 mpy

SCU Btms

Coke Pot

2012 T/A
Subtle TAN Changes

Data did not point to accelerated corrosion
Challenge #3 - Desalting

- Tank switches to new heavy crude caused upsets
- Proactive increase in demulsifier alleviated problem
Challenge #3 – Desalting Part 2

Try-line | 8/16/10 10:00 AM | 8/17/10 8:00 AM | 8/17/10 2:00 PM | 8/23/10 7:00 AM
--- | --- | --- | --- | ---
69” | O | O | O | O
66” | O | O | O | O
60” | O | O | O | O
51” | DW | E | E | DW
42” | DW | DW | E | E
36” | DW | DW | E | E
30” | DW | DW | DW | E

Timeline

10:00 AM 8/17 EB dose increased & mix valve decreased
11:00 AM 8/17 Problem crude starts
2:00 PM 8/17 Desalter severely upset

**Timeline**

8/17/10 0:00 8/18/10 3:00 8/18/10 6:00 8/18/10 9:00 8/18/10 12:00 8/18/10 15:00

**Filterable Solids Content (ptb)**

0 300 600 900 1200 1500 1800 2100 2400

**Normal Solids**

Normal Solids
Challenge #4 - Fouling

- **Asphaltene stability related problems**
  - Been linked to:
    - Desalter upsets
    - Preheat train fouling
  - Some feedstocks may contain precipitated asphaltenes

- **High solids**
  - Linked to desalting problems
  - Furnace fouling – vacuum and coker
Phillips 66 Approach to Canadian Crudes

- Practical understanding through internal applied research
  - Corrosion
  - Desalting
  - Fouling

- Participation in industry projects
  - CCQTA
  - Ohio U naphthenic acid corrosion JIP

- Understand refinery experience

- Set reasonable limits to minimize problems

- Capital upgrades where economically justified to run higher %’s of more challenging crudes
The boom in Canadian Heavy and Shale Liquids production creates both opportunities and challenges for US Refiners. Issues not just with individual crudes but also with how they interact with other crudes in the slate. Reliably processing these challenging feedstocks requires:

- Understanding of refinery impacts
- Developing strategies to manage issues
Questions??