When is the “Day of Reckoning” and how will the industry respond?

2014 EIA Energy Conference
July 14, 2014
Washington, D. C.

John R. Auers, P.E.
Executive Vice President
Pre U.S. Crude Boom (~2007/2008)

Export regulations irrelevant.

Declining U.S. crude production replaced by increasing imports – exceed 10 MM BPD

Light & Medium waterborne imports make up almost 60% of total imports.

U.S. refinery utilization holds in the mid 80% range.
Today

- U.S. production rises 70% from 2008.
- Canadian imports grow over 35% as oil sands production increases.
- Increasing production squeezes out waterborne light imports – total light/medium waterborne imports down to 2.7 MM BPD
- U.S. refinery utilization rises to near 90%.
Future

“Day of Reckoning” when production exceeds capabilities of refining system

Max Sustainable Refinery Utilization ~92%

- Export restrictions incentivize increased refinery utilization
- U.S. production continues to grow
- Canadian imports to U.S. continue to grow; P/L delays limit ability of Canadian crude to reach tidewater
- Waterborne imports decline to “structural” minimum levels (Latin heavy/Saudi/other)
- U.S. refinery utilization maxes out; with exports restricted there is no where else for new production to go
Factors Influencing “Day of Reckoning” When Export Restrictions “Strand” Domestic Crude

• Actual Level of Production Growth
  – Estimates vary widely
  – EIA Reference Case has 2013 to 2020 growth at 2.1 MMBPD; High Resource Case is 4.0 MMBPD

• Ability to Expand Exports to Canada
  – 2013 Light/Medium Waterborne (non-U.S.) Imports into Canada > 500 MBPD
  – 2013 Light/Medium Imports into U.S. from Canada = 1.0 MMBPD
  – Dependent on build-out of Canadian pipelines to Tidewater

• Ability to Access West Coast Markets
  – This would also influence economics for exporting ANS
  – Infrastructure build out delayed by local opposition/California LCFS will also impact crude decisions

• Ability of U.S. Refining System to Displace Lt. Sour/Medium Crudes
  – Very dependent on Saudi market decisions

• Level of U.S. Processing Additions/Increased Utilization at Existing Plants
  – These include both additions inside and outside refinery gates

• How Current Export Restrictions are Applied
  – What does recent BIS “clarification” mean/what is the impact?

• “Day of Reckoning” Could be as early as 2015/16 or after 2020+
Day of Reckoning Scenarios

Thousand BPD

Day of Reckoning Scenarios

Saudi crude remains in U.S. at current levels

- Refinery Utilization Increases
- Refinery Expansions
- Condensate Stabilizers/Splitters
- Canadian Imports/Exports
- WB non-Saudi PADD 5 Lt.+Med.
- WB non-Saudi PADD 1+3 Lt.+Med.
- EIA Reference Case
- EIA High Resource Case
Saudi imports remain and infrastructure delays limit domestic crude to West Coast (PADD V)
LLS-WTI Experience

At parity through 2006

Market recognizes disconnect – 2007 to 2010

Stranded with booming production – massive and volatile discount 2011-2013

Sale of 30 MMBBL from U.S. SPR

Arab Spring sparks crude price rises, LLS outpaces WTI

Investment results in quality and transportation adjusted parity

Seaway acquisition announced

Inventories build in Cushing

Seaway reversal, 150kbp Cushing to Houston

Seaway expansion, 150-400 MBPD

Investment results in quality and transportation adjusted parity
Domestic-to-International Discount

Brent (Dated) – LLS (St James) Forecast

Increasing volatility during transition

LLS transitions to discount as light crude imports disappear

Eventually discount declines to level based on investment economics

Large "Cone of Uncertainty" - substantial volatility

At import parity through 2010

$ Per Barrel


Actual  Forecast - Exports Restricted

Turner, Mason & Company
CONSULTING ENGINEERS
Industry Already Making Investments

• Made to provide industry the ability to run very light crudes and condensates – delays “Day of Reckoning”

• Most being done within refinery gates
  – Focused on Eagle Ford; also some Utica
  – Refinery specific/new atmospheric units, pre-flash towers, etc.

• Upstream and midstream also making processing investments
  – Field condensate stabilizers – to facilitate safe storage and transportation
  – EF Condensate splitters – located on the coast (Corpus Christi and Houston)

• Additional “opportunistic” investments to take advantage of regional proximity to advantaged crudes
  – PADD IV/North Dakota/Permian
  – Size limited by regional demand
Investments in Reaction to Saturation

- Made to convert crude to “exportable” products
- Market/regulatory uncertainty will incentivize low cost/complexity projects
  - Similar to forces driving crude-by-rail vs. pipeline
  - No incentive to add to global gasoline surplus
- Various types – will depend on governmental guidelines
  - Current rulings would favor simple crude stabilizer
  - Large USGC located facilities to process growing WTI crude would meet current criteria
  - Other facilities would also be built/WTI diesel hydroskimmers could become price-setter if BIS imposes “minimum” criteria on definition of distillation
- Midstream segment likely to sponsor many of the projects
- Conversion of existing heavy crude refineries to light crude is least attractive option
Processing Options

Distillation

Field Condensate Stabilizer
- Capacity: ~5 mbbl/day
- Cap. Cost: ~ Several million $
- Op. Cost: $0.50-$1.00/B
- Construction: ~12 months

USGC Crude Stabilizer
- Capacity: 100 mbbl/day
- Cap. Cost: $150 - 200 MM
- Op. Cost: $0.75-$1.00/B
- Construction: 12-18 months

Condensate Splitter
- Capacity: 100 mbbl/day
- Cap. Cost: $300-400 MM
- Op. Cost: $1.00 to $1.50/B
- Construction: 18-24 months

Increasing Level of Separation and Complexity
**Processing Options**

**Refining**

<table>
<thead>
<tr>
<th>Distillate Hydroskimmer</th>
<th>Light Crude Refinery</th>
<th>Heavy Crude Refinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity: 100 mbbl/day</td>
<td>Capacity: 200 mbbl/day +</td>
<td>Capacity: 200 mbbl/day +</td>
</tr>
<tr>
<td>Op. Cost: $2.00-$3.00/B</td>
<td>Op. Cost: $3.00-$5.00/B</td>
<td>Op. Cost: $5.00-$7.00/B</td>
</tr>
<tr>
<td>Construction: 2 to 3 years</td>
<td>Construction: 3+ years</td>
<td>Construction: 4+ yrs</td>
</tr>
</tbody>
</table>

**Increasing Level of Separation and Complexity**
Economic Ranking of Processing Options
Based on Capital and Operating Costs and TM&C Product Price Forecast

- Increased USGC Utilization
- USGC Refinery "Add-On" Hydroskimmer (USGC product $)
- USGC Greenfield WTI Simple Stabilizer
- USGC Greenfield WTI "Add-On" Hydroskimmer (Export product $)
- USGC Greenfield WTI Hydroskimmer (Export product $)
- Heavy Crude Refinery Revamp

Increased Level of Required Discount

Turner, Mason & Company Consulting Engineers
Final Thoughts

• U.S. Prod. Growth On-Pace to Surpass Light/Medium Domestic Refining Capacity
  – “Day of Reckoning” influenced by many factors – anywhere from 2015/16 to 2020+
  – Domestic prices already impacted for “problem crudes” and during T/A season
• Strict Export Restrictions could Lead to “Stranded Crude”
  – Domestic prices discounted; situation similar to WTI/LLS experience
  – Large “Cone of Uncertainty” - Duration and depth of discount hard to predict/volatile
• Industry Responds with Investment in Crude-to-Product Facilities
  – Investment delayed by policy uncertainty
  – Ultimate discount based on incremental cost of marginal investment type
• Recent BIS “Clarification” is a starting point – is there more to come?
  – With no additional limitations, low cost USGC crude stabilization would become the marginal investment – low hurdle/limited domestic crude discounts
  – USGC distillate hydroskimmer could be price setter with more restrictive rulings
• Hydrocarbon Exports Poised to Grow – U.S. To Become Net Exporter – Policies Key
  – All segments of U.S. industry are world leaders in efficiency and technology
  – Policies impacting costs, access, demand will influence future competitiveness
Presenter

John R. Auers, P.E.
Executive Vice President

- Univ. of Nebraska Chem. Engr.
- Univ. of Houston MBA
- Formerly with Exxon
- Industry studies/analysis, forecasting, modeling
- Leads Outlook team
- Contact Info – jauers@turnermason.com
  Office – 214-223-8887
Extra Slides
## Refinery Expansions

### Required Crude Expansions

<table>
<thead>
<tr>
<th>Operator</th>
<th>Location</th>
<th>MBPD*</th>
<th>Startup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flint Hills</td>
<td>Corpus Christi, TX</td>
<td>30</td>
<td>Late 2014</td>
</tr>
<tr>
<td>Valero</td>
<td>Houston, TX</td>
<td>90</td>
<td>2Q 2015</td>
</tr>
<tr>
<td>Valero</td>
<td>Corpus Christi, TX</td>
<td>70</td>
<td>3Q 2015</td>
</tr>
<tr>
<td>Marathon</td>
<td>Canton, OH</td>
<td>10</td>
<td>2014</td>
</tr>
<tr>
<td>Marathon</td>
<td>Catlettsburg, KY</td>
<td>35</td>
<td>2015</td>
</tr>
</tbody>
</table>

### Opportunistic Crude Expansions

<table>
<thead>
<tr>
<th>Operator</th>
<th>Location</th>
<th>MBPD</th>
<th>Startup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakota Prairie Refining/Calumet</td>
<td>Dickinson, ND</td>
<td>20</td>
<td>2014-2015</td>
</tr>
<tr>
<td>Valero</td>
<td>Mckee, TX</td>
<td>25</td>
<td>2015</td>
</tr>
<tr>
<td>HollyFrontier</td>
<td>Woods Cross, UT</td>
<td>29</td>
<td>2015/16</td>
</tr>
<tr>
<td>Calumet</td>
<td>Great Falls, MT</td>
<td>10</td>
<td>2015</td>
</tr>
<tr>
<td>Tesoro</td>
<td>Salt Lake City, UT</td>
<td>4</td>
<td>2015</td>
</tr>
</tbody>
</table>

*Project will allow refinery to run higher volumes of very light crude and condensate from regional tight oil production. Estimated total expansion of crude capacity is not necessarily equal to capacity of new condensate splitter or preflash tower and is TM&C's estimate.
## Condensate Splitters

### Under Construction

<table>
<thead>
<tr>
<th>Operator</th>
<th>Location</th>
<th>MBPD</th>
<th>Startup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kinder Morgan, Phase 1</td>
<td>Houston, TX</td>
<td>50</td>
<td>2Q 2014</td>
</tr>
<tr>
<td>Kinder Morgan, Phase 2</td>
<td></td>
<td>50</td>
<td>2Q 2015</td>
</tr>
<tr>
<td>Trafigura</td>
<td>Corpus Christi, TX</td>
<td>50</td>
<td>4Q 2014</td>
</tr>
</tbody>
</table>

### Proposed

<table>
<thead>
<tr>
<th>Operator</th>
<th>Location</th>
<th>MBPD</th>
<th>Startup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magellan</td>
<td>Corpus Christi, TX</td>
<td>50</td>
<td>2H2016</td>
</tr>
<tr>
<td>Martin Midstream</td>
<td>Corpus Christi, TX</td>
<td>Up to 100</td>
<td>1-2Q 2016</td>
</tr>
<tr>
<td>Targa Resources</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Castleton Commodities</td>
<td>Corpus Christi, TX</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Phillips 66</td>
<td>Sweeny, TX</td>
<td>TBD</td>
<td>TBD</td>
</tr>
</tbody>
</table>
Pre-Flash Column Process Flow
Simple Stabilizer Process Flow
Complex Stabilizer Process Flow

- Crude / Condensate
- Wash Water
- Desalter
  - Brine
  - Gas/LPG
  - Naphtha
- Stabilizer
  - Customizable Crude Feedstock
Condensate Splitter Process Flow

- Condensate
- Water
- Desalter
- Brine
- Optional
- Condensate Splitter
- NGLs
- Naphtha
- Kerosene
- Diesel
- Crackable ATB
WTI Hydroskimmer Block Flow

[Diagram showing the flow of crude oil through various units and processes, resulting in different products such as C3/C4, Natural Gasoline, Heavy Naphtha, ULSD, FCC Feed, SR Resid, and sulfur recovery.]

25