Differences in Differentials
Evaluating Natural Gas and Crude Oil Prices in Wyoming

Wyoming Gas Fair
September 18, 2014
Jackson, WY

Price difference between natural gas in Wyoming and natural gas in Louisiana

Wyoming price difference in $ per MMBtu

Jan-93   Jan-94   Jan-95   Jan-96   Jan-97   Jan-98   Jan-99   Jan-00   Jan-01   Jan-02   Jan-03   Jan-04   Jan-05   Jan-06   Jan-07   Jan-08   Jan-09   Jan-10   Jan-11   Jan-12   Jan-13   Jan-14   Jan-15

(7.00)   (6.00)   (5.00)   (4.00)   (3.00)   (2.00)   (1.00)   0.00   1.00

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Forecasted future differentials based on long run marginal cost to transport gas out of the Rockies $0.30 - $0.60
How about doing the same thing for crude oil for 2014?

Perception of Crude Differential depends on what proxy price used

Increasing marginal transportation cost

differentials based on long run marginal cost to transport gas out of the Rockies $0.30 - $0.60
Perception of Crude Differential depends on what proxy price used

$ per barrel

Perception of Crude Differential depends on what proxy price used

$ per barrel
Perception of Crude Differential depends on what proxy price used

[Chart showing fluctuation of $ per barrel from Jan-12 to Apr-14]
Perception of Crude Differential depends on what proxy price used
Perception of Crude Differential depends on what proxy price used

Spread between highest and lowest
Perception of Crude Differential depends on what proxy price used

Cutting through the clutter

Source: EIA First Purchaser Data
Some differences between gas and oil

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Natural Gas</th>
<th>Crude Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price Transparency</td>
<td>Hub prices in WY and elsewhere</td>
<td>WTI and a few other places</td>
</tr>
<tr>
<td>Capacity data</td>
<td>4X per day</td>
<td>nope</td>
</tr>
<tr>
<td>Shipper data</td>
<td>4X per year</td>
<td>nope</td>
</tr>
<tr>
<td>Rates data</td>
<td>All</td>
<td>Some</td>
</tr>
<tr>
<td>Rates large factor in delivered cost</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Choice of pipe or              ?</td>
<td>No</td>
<td>Yes (rail)</td>
</tr>
<tr>
<td>FERC response</td>
<td>Strong</td>
<td>Not so strong</td>
</tr>
</tbody>
</table>

Building a model for crude in Wyoming

- Hiland
- PRB
- Bridger and Belle Fourche
- Platte
- Cheyenne Refining
- Denver Refining
- PXP
- Guernsey

Denver Refining
Building a model for crude in Wyoming

Big Horn Basin

Express

Hiland

PRB

Bridger and Belle Fourche

Casper

Platte

Guernsey

Platte

Cheyenne Refining

PXP

Casper/Rawlins Refining

Denver Refining

DJ
Building a model for crude in Wyoming

Solving this model is difficult and wouldn’t fully answer the question of the differential
**Approximate costs to your final destination**

<table>
<thead>
<tr>
<th>Pipeline Rate Components</th>
<th>Range of rates</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting off lease</td>
<td>$1 - $3</td>
<td>Gathering/trucking</td>
</tr>
<tr>
<td>Pipeline tariff Guernsey to Cushing</td>
<td>$4 - $6</td>
<td>Age and distance affect rates</td>
</tr>
<tr>
<td>Range for Pipeline</td>
<td>$5 - $9</td>
<td><strong>Using $7 in examples to follow</strong></td>
</tr>
</tbody>
</table>

**Approximate costs to your final destination**

<table>
<thead>
<tr>
<th>Rail Rate Components</th>
<th>Range of rates</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting off lease</td>
<td>$1 - $3</td>
<td>Gathering/trucking</td>
</tr>
<tr>
<td>Rail car lease costs</td>
<td>$2 - $4</td>
<td>Lease rates vary with market and turn around time on cars</td>
</tr>
<tr>
<td>Rail terminal loading</td>
<td>$1 - $2</td>
<td>Spot/term</td>
</tr>
<tr>
<td>Rail transportation</td>
<td>$5 - $8</td>
<td>Unit v. Manifest/Distance</td>
</tr>
<tr>
<td>Range for Rail</td>
<td>$9 - $17</td>
<td><strong>Using $11 - $13 in examples to follow</strong></td>
</tr>
</tbody>
</table>
Preferred destination depends on market and costs

PacNW  →  North Dakota  →  East Coast

Wyoming  →  North Dakota

Utah  →  Wyoming  →  Denver  →  Cushing  →  Louisiana

$13

Califonia  →  Denver  →  Cushing  →  Louisiana

$13

$7

$11

Pipeline path

Rail path
Preferred destination depends on market and costs

PacNW

North Dakota

East Coast

Wyoming $97

Utah $7

Denver $11

Cushing $90

California

North Dakota

East Coast

Wyoming $89

Utah $7

Denver $11

Cushing $90

California

Louisiana

Utah

Denver

Cushing

Louisiana

North Dakota

East Coast

Wyoming $97

Utah $7

Denver $11

Cushing $90

California

North Dakota

East Coast

Wyoming $89

Utah $7

Denver $11

Cushing $90

California

Louisiana
Preferred destination depends on market and costs

So where does that leave Wyoming?

Fortunate that:
  • rail is an option
  • have both BNSF and UP
  • pipeline additions do happen
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• rail is an option
• have both BNSF and UP
• pipeline additions do happen

Expect that:
• Prices at market hubs and refining will influence delivery mode and netback
• Rail and pipeline built will cycle back and forth as explanation for price at any point in time
• WTI via pipe is the long run floor on price