Liquids From Shales

11th Annual Tulane Engineering Forum

Tom Sherman
April 15, 2011
Agenda: Liquids From Shales

- U.S. Supply Overview
- Resource Plays
- Price Relationships Between Dry Gas, Wet Gas and Crude
- Where Do the Liquids Come From?
- Shifting Corporate Strategies – Rigs Do Their Talking
- Economics of Liquid Plays
Strong Production Growth Since 2005

U.S. Dry Production

Current Dry Production Levels Pushing All Time Highs

Hurricanes Gustav and Ike

Hurricane Katrina

12.6 Bcf/d Incremental Growth

Emergence of Giant Shale Plays
Advanced Drilling and Well Completion Technology
Horizontal Well Drilling
Higher Prices

Bcf/d Dry Production

Source: BENTEK Pipeline Flow Data From --- Daily Supply and Demand Report
Weak Prices Fail To Curtail Production as Efficiencies Overtake Declines

Rig Count and Production Relationship Falls Apart

Source: RigData, BENTEK Supply and Demand Report April/2011
U.S. Active Rig Locations: Resource Plays Dominate

Williston Basin Bakken Shale (Oil Play)

Pinedale/Jonah Tight Gas

Uinta – Piceance

Niobrara Shale Play (Oil Play)

Granite Wash Tight Gas Sands

Barnett Shale Gas Play

Permian Basin-Oil Targets

Woodford Shale Gas Play

Eagle Ford Shale Play

Fayetteville Shale Gas Play

Haynesville Shale Gas Play

Marcellus Shale Gas Play

U.S. Active Rigs

0 200 400 600 800 1000 1200

BENTEKENERGY.COM

Source RigData and BENTEK: Lower 48 States, April/2011
Gas, Oil and NGL Price Comparison

Source: ICE, EIA
Gas, Oil and NGL Price Comparison: MMBTU Equivalent

NGL Value Keeps Track With Crude

Value Gap

Source: ICE, EIA
Gas and Oil Not Trading On BTU Equivalent

If Traded on a BTU Equivalent the Ratio Should Be ~ 6

2011ytd = 23
2010 Avg. = 18.6

5 Yr. Avg. = 13.4
2006 - 2010

Source: ICE, EIA
Characteristics of World Class Liquids Shale Plays

When All These Come Together – Lease Prices Soar.
$5,000 - $10,000 /acre

Application of Horizontal Drilling Technologies
Repeatable Over a Large Area
Large In-Place Reserve Base
Combination of Liquids and Gas – Key Geologic Criteria

Bakken Shale
Eagle Ford
Marcellus (SW)
Niobrara Shale (Emerging)
Natural Gas Liquids (NGLs)

Field Separation
Condensation, Oil, Water

Gas Gathering Systems
From Numerous Wells and Fields

Interstate Pipelines To End-users

Raw NGL’s
Pipes, Trucks or Rail

High BTU Content Gas

Dry Gas

NGL Fractionator

Gas Processing Plant

Ethane
Propane
Normal Butane
Isobutane
Natural Gasoline

Fractionated NGL Components

Refrigeration
Petrochemical
Industrial
Heating
Components of NGL Barrel

- **Ethane (C₂H₆)** 40% → *Compounds*: Ethylene
  *Major Uses*: Building Block for Most Plastics

- **Propane (C₃H₈)** 30% → *Compounds*: Propylene, Heating Fuel
  *Major Uses*: Res/Com Heating, Paints, PVC, Adhesives

- **Normal Butane (C₄H₁₀)** 10% → *Compounds*: Butylene
  *Major Uses*: Refrigerant, Propellants

- **Isobutane 10%** → *Compounds*: Isobutylene
  *Major Uses*: Refrigerant, Propellants

- **Natural Gasoline (C₅H₁₂)** 10% → *Major Uses*: Petrochem Feedstock, Motor Gasoline
U.S. NGL Production - Gas Plants

All Time High Hit in November 2010

- Propane
- Normal Butane
- Isobutane
- Pentanes Plus
- Ethane
Liquid Rich Plays Attract Attention

Rig Additions Since Recent Low - May 2009

North-South “Liquids” Fairway Developing

Not all rigs/basins shown on map, total lower than 1095

Source: RigData and BENTEK: Lower 48 States, April 2011
Transfer of Drilling Technology To Liquid Rich and Oil Plays

Horizontal Rig Additions Since – Jan. 2010

- Gas Focused Areas
- Liquids Rich/Oil Focused Areas
- Rig Declines

Source RigData and BENTEK: Lower 48 States, April 2011

Map Adds to 516 Hor. Rigs. 8 misc. other rigs not shown.
The Move To Crude --- Liquid Uplift $$

Revenue From 1,000 Mcfe

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<tr>
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<th>$0</th>
<th>$5,000</th>
<th>$10,000</th>
<th>$15,000</th>
<th>$20,000</th>
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<td>Dry Gas 1,000 Btu</td>
<td>$4,000</td>
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<tr>
<td>Wet Gas - Unprocessed - 1,250 Btu</td>
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<td>$5,000</td>
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<tr>
<td>Processed Gas - 1,250 Btu</td>
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<td>$7,162</td>
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<td>Crude Oil</td>
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<td>$10,230</td>
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1,000 Mcf of 1,000 BTU Gas Processed
770 Mcf Dry Gas
125 Bbls NGLs

1,000 Mcf of 1,000 BTU Gas Converted to Oil Equivalent ~5.8 to 1

Gas = $4.00/MMbtu, NGLs = $57.30/Bbl, Crude = $105.00/Bbl
Shale Play Economics

Haynesville Shale (LA) Active Rigs

- Grand Total
- DIR
- HOR
- VER
- % Horizontal

Haynesville Shale

Eagle Ford Shale

- Horizontal Rigs
- Directional Rigs
- Vertical Rigs

- D&C = $8.5 million
- IP = 12,000 Mcf/d
- BTU = 1020
- 1st Year Decline = 80%
- Breakeven = $3.66
- IRR @ $4.95 = 14.5%

(Two Year Average Forward Curve)
Shale Play Economics

**Haynesville - Dry Gas Region:**

- **D&C** = $8.5 million
- **IP** = 12,000 Mcf/d
- **BTU** = 1020
- **1st Year Decline** = 80%

**Breakeven** = $3.66

**IRR @ $4.95 = 14.5%**

*(Two Year Average Forward Curve)*

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**Haynesville Shale**

**Eagle Ford Shale**

- **Horizontal Rigs**
- **Directional Rigs**
- **Vertical Rigs**
Oil Window

Wet Gas Window

Dry Gas Window

Corpus Christi
**Wet Gas Region w/Condensate:**

- D&C = $7.5 million
- IP = 5,000 Mcf/d
- Condensate = 250 Bbls/d
- BTU = 1,250
- 1st Year Decline = 71%
- NGL’s = 125 Bbls/MMcf
- Residual Dry Gas = 23% Shrink

**Wet Gas Region:**

- D&C = $7.5 million
- IP = 5,000 Mcf/d
- Condensate = Assume No Condensate
- BTU = 1,250
- 1st Year Decline = 71%
- NGL’s = 125 Bbls/MMcf
- Residual Dry Gas = 23% Shrink

**Dry Gas Region:**

- D&C = $8.5 million
- IP = 9,000 Mcf/d
- BTU = 1020
- 1st Year Decline = 77%

**Breakeven = < $1.00**

**IRR @ $4.95 = 63%**
*(Based on Two Year average Forward Curve)*

**Breakeven = < $1.00**

**IRR @ $4.95 = 35%**
*(Based on Two Year average Forward Curve)*

**Breakeven = $4.56**

**IRR @ $4.95 = 3%**
*(Based on Two Year average Forward Curve)*

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**Oil Window**

**Wet Gas Window**

**Dry Gas Window**

**Corpus Christi**

- Horizontal Rigs
- Directional Rigs
- Vertical Rigs
Key Takeaway Points

• U.S. Supply Has Been Pushed to Record Levels Due to Shale Gas Plays

• Natural Gas Prices Have Remained Low Due to Excess Supply

• Natural Gas Liquids Increasing as a Result of New Wet Gas Plays

• NGL Prices Tracking Crude Prices

• Producers Are Adjusting Strategies to take Advantage of Higher Liquid Prices

• Economics Very Attractive in Wet Gas and Crude Plays
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