WEST VIRGINIA’S APPROACH TO ATTRACTING ETHANE CRACKER INVESTMENTS

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Governor Earl Ray Tomblin
State of West Virginia
OVERVIEW

- Anticipating volumes of downstream markets for ethane;
- Identifying end uses for ethane close to the Marcellus play in the near future
- Examining opportunity for establishing an ethane market; and
- West Virginia’s Competitive Advantage.
WEST VIRGINIA MARCELLUS TO MANUFACTURING TASK FORCE

- Created by Executive Order No. 1-11 by Governor Tomblin

- Comprised of executives with expertise in production activities, midstream activities, chemical manufacturing, transportation issues, economic development, environmental matters and labor issues
GOALS OF TASK FORCE

- Analyze the feasibility of converting ethane to ethylene in West Virginia
  - Quantify projected volumes of ethane production
  - Identify available sites in West Virginia conducive to location and operation of ethane crackers
- Locate and analyze existing infrastructure within West Virginia, including pipelines and storage facilities
GOALS OF TASK FORCE (CONT'D.)

- Identify potential companies that specialize in constructing and operating ethane crackers
- Identify companies willing to invest capital and other resources into the natural gas industry, ethane conversion facilities and revitalization of West Virginia’s chemical and manufacturing industries
- Formulate a comprehensive Marcellus To Manufacturing Action Plan
FOUNDATIONS OF ETHANE MARKET

- Thriving Natural Gas Industry
- Robust Marcellus Production
- Public policies that require responsible development
  - Environmental regulations that strike an appropriate balance between protecting the environment and allowing responsible production and transportation of natural gas
  - Executive Order No. 4-11 & DEP Emergency Regulations
  - Legislative Regulatory Bill
Anticipating volumes of downstream markets for ethane
DOWNSTREAM MARKETS OUTSIDE OF MARCELLUS PLAY

- Sarnia, Ontario, Canada
  - Mariner West Project
- Gulf Coast, United States
  - Enterprise
  - Mariner East Project
- European Destinations
  - Mariner East Project
MARINER WEST PROJECT

MARINER WEST PROJECT

- Ethane Pipeline to Sarnia, Ontario, Canada
  - Range Resources and Caiman Energy have agreed to long-term ethane supply agreements with Nova Chemicals. Other regional producers may also have committed capacity to this project
  - Transport Marcellus ethane from MarkWest’s Houston, PA fractionator to Sarnia, Ontario predominately using Sunoco Logistics pipelines
  - Mariner West is expected to transport 50,000 Bbl/day
ENTERPRISE PIPELINE

- Ethane Pipeline to Gulf Coast Region, USA
  - Approximately 1,230 mile pipeline
  - Transport Marcellus and Utica Shale ethane from Appalachian Basin to the Gulf Coast
  - The Enterprise project is anticipated to have an initial capacity to transport up to 125,000 Bbl/day, which could be expanded
  - Chesapeake recently reserved 75,000 Bbl/day of transportation capacity on this project
MARKWEST ENERGY PARTNERS, L.P.

Project Mariner: A Comprehensive Ethane Solution

- MarkWest Liberty and Sunoco Logistics have created effective solutions for ethane that would provide access to attractive NGL markets in North America and Europe.
- Timely start up in second half of 2012 for transportation to Sarnia with future incremental ethane deliveries bound for favorable European and Gulf Coast Markets.
- Project Mariner requires minimal pipeline construction – a combined total of 75 miles of new pipe is required to deliver ethane to Sarnia, Gulf Coast and European markets.
- Project Mariner would have access to ethane storage at Marysville and Philadelphia.
- Project Mariner is scalable and can be staged to meet producer’s “must recover” and “optional” supplies of ethane.

SUMMARY OF NON-MARCELLUS REGION DOWNSTREAM MARKETS

- Sarnia, Ontario, Canada
  - 50,000 Bbl/day via Mariner West
  - Projected to be operational in late 2013 / early 2014

- Gulf Coast, USA
  - Up to 125,000 Bbl/day initially via Enterprise
  - Projected to be operational 1st quarter 2014
  - Incremental volumes via expanded Enterprise or Mariner East

- Total non-Marcellus demand – up to 175,000 Bbl/day of Appalachian Basin ethane
Identifying end uses for ethane close to the Marcellus play in the near future
WEST VIRGINIA AND THE CHEMICAL INDUSTRY – A BRIEF HISTORY

- From 1972 to 1992, West Virginia lost thousands of jobs in the chemical industry due to industry decline and corporate restructuring.

- Today, West Virginia remains the home to significant chemical operations – operations that are well positioned to be expanded and reinvigorated with a stable, cost-effective ethane supply.
MARCELLUS ETHANE’S POTENTIAL TO REVITALIZE CHEMICAL INDUSTRY

- West Virginia has numerous chemical sites with room to expand
- Local conversion of Marcellus ethane into ethylene has the opportunity to create new market efficiencies and generate a groundswell of new petrochemical activity in West Virginia involving ethylene and polyethylene
- West Virginia stands ready to work with those companies seeking to invest in ethane to ethylene conversion facilities in our state
Examining opportunity to establish an ethane market
KEYS TO ESTABLISHING MARKETS FOR ETHANE

- Demonstrate to petrochemical companies that West Virginia is a willing, capable partner for ethane cracker investments
  - Adequate, Stable Supply of Ethane
  - World-Class Midstream Infrastructure and Facilities
  - Feasible Ethane Storage Capabilities
  - Suitable, Advantaged, Developable Sites
ETHANE SUPPLY – MORE THAN ADEQUATE

<table>
<thead>
<tr>
<th>Company</th>
<th>Production (Bbl/day)</th>
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<tr>
<td>MarkWest – Southwestern, PA/Northern, WV</td>
<td>120,000</td>
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<tr>
<td>(Houston, Pa, Majorsville, WV, etc.)</td>
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<tr>
<td>MarkWest – Siloam, KY</td>
<td>20,000</td>
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<tr>
<td>Dominion (Hastings, WV and Natrium, WV)</td>
<td>50,000</td>
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<tr>
<td>Caiman Energy (Northern WV Fractionator)</td>
<td>80,000</td>
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<td><strong>Total Ethane Production EOY 2015</strong></td>
<td><strong>270,000 Bbl/day</strong></td>
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<tr>
<td>Less: Mariner West Demand</td>
<td>(50,000 Bbl/day)</td>
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<tr>
<td>Less: Enterprise/Mariner East Demand</td>
<td>(125,000 Bbl/day)</td>
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<tr>
<td><strong>Remaining Ethane Volumes</strong></td>
<td><strong>95,000 Bbl/day</strong></td>
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PROCESSING PLANTS, FRACTIONATORS & PIPELINES

[Map of West Virginia showing gas lines and processing plants, fractionators, and pipelines.]

WEST VIRGINIA

GAS LINES

- Battleford
- Cadet
- Clinton
- Columbia Lines
- Columbia NGL Pipeline
- Columbia Western Trunkline
- Columbia Eastern Trunkline
- Mapleton System
- Marcellus Shale
- Marcellus Gas Pipeline
- Marcellus East Line Lateral
- Marcellus Ranger Line
- Marcellus Ranger Line

[Legend for gas lines and processing plants.]
Mariner West - 50,000 bbl/day
Enterprise/Mariner East - 125,000 bbl/day

Supply

Houston, PA - MarkWest
Hastings, WV - DTI
Natrium, WV - DTI
Natrium, WV - Caiman

Demand

Mariner West - 50,000 bbl/day
New Martinsville, WV - Bayer/PPG - 60,000 bbl/day
New Martinsville, WV - PPG Cavern Storage
Cornwell/Cobb, WV
Institute, WV - Bayer - 60,000 bbl/day
Depleted Reservoir or Mined Storage - Kanawha, Putnam, and Jackson Counties

Total Mileage = 271
## WV ETHANE PIPELINE ECONOMICS

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<th>$150,000/inch-mile</th>
<th>$180,000/inch-mile</th>
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<td>Natrium, Ranger Spurs</td>
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<td><strong>Total Capex-$MM</strong></td>
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<td><strong>Demand Determinants-</strong></td>
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<td>BBL/Day</td>
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<td><strong>Demand Rate-Cents/Gallon</strong></td>
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<td><strong>Term-Years</strong></td>
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<td><strong>After Tax-IRR-%</strong></td>
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ETHANE STORAGE SOLUTIONS

- WV Development Office commissioned storage study from PB Energy, a division of Parsons Brinckerhoff
  - PBESS identified three opportunities for underground ethane storage in WV
    - Salt Caverns
    - Hard Rock Caverns
    - Porous Material/Depleted Reservoirs
  - Phase I deliverables have been delivered
WEST VIRGINIA’S COMPETITIVE ADVANTAGE
2-3 cent/gallon Appalachian ethane system provides cracker with significant feedstock value

Marcellus producers that supply ethane to Appalachia enjoy an approximate 12 cent/gallon ethane netback advantage based on expected transportation costs to Sarnia, Ontario, Canada and the Gulf Coast

These savings should provide producers an alternative market for the ethane produced from the Marcellus Shale
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