US Ethane Outlook
Complacency to Possible Panic?

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Introduction

- The surge in ethane extraction capability, driven by the shales, has caused an oversupply of ethane in the US.
- US petrochemical companies are enjoying record margins and are aggressively expanding ethane cracking capacity.
- Foreign markets want access to cheap US ethane supplies and waterborne exports of US ethane will soon become a reality.
- Large midstream players have been adding logistics to handle ethane; and, in some cases, constructing export terminals.
- For US producers and gas processors, the surplus has resulted in negative ethane extraction margins and ethane rejection.
- Overall, there is a feeling of complacency that US ethane will remain oversupplied for the foreseeable future.
Considering that More Gas Processing Capacity is on the Way

It Begs the Following Questions Regarding US Ethane:

- How much larger will the surplus be for ethane?
- What will be the regional distribution of ethane supplies?
- How much ethane will and can be rejected?
- Will the US ethylene industry be able to expand fast enough to absorb additional ethane supplies?
- How much ethane will be available for export?
- What price will it take to bring the marginal ethane barrel to market?
Background Information on US Ethane

Gas processing ethane constitutes over 95% of US supplies. Small amount of ethane from crude oil refining (<5%).

Extraction from gas processing can be mostly discretionary:

- Depends on economics, processing region, quality of inlet gas, availability of lean gas for blending, type of processing plant.
- Contractual obligations can restrict ethane rejection – “frac or pay”, “transport or pay”, and minimum content in y-grade.
- Also, ethane rejection can be limited to avoid propane losses or exceed the BTU specs of long-haul gas pipelines.

US ethane has one major end-use -- ethylene production.

- Numerous suppliers versus a small number of ethylene plants – nearly 600 processing plants vs 37 ethylene plants.
- Ethane balances highly dependent on the operational reliability of the ethylene industry and its ability to complete expansions.
US Ethane Extraction Capability*, Actual Extraction and Rejection

US Ethane Extracted and Rejected - Jan-00 to Jun-14
(Thousand BPD)

Periods of High Gas-to-Crude Ratios

- 135% Gas/WTI
- 102%
- 116%
- 72%

C2 Extraction Capability

C2 Extraction Capability: 1.36 MM BPD

Actual Ethane Extraction: 1.10 MM BPD

Actual C2 Extraction

Estimated C2 Rejection

- 43% C2 rejection
- 33%
- 33%
- 28%
- 22%

Estimated Ethane Rejection: 260 MBPD

* Extraction capability is the amount of an NGL that can be reasonably extracted barring economic or logistical constraints.
Since 2012, the crash in ethane frac spreads crash has reflected the imbalance of ethane supply and demand.
Ethane Inventories At Record Highs

Even with ethane rejection exceeding 250 MBPD, ethane inventories have surged since Jan-2014.
In the Short Term, Growing Supplies Are Not Totally Responsible for Ethane’s Surplus

State of US Ethylene Industry H1 2014

2014 Ethane Cracking Capability vs Actual Ethane Cracked (1000 BPD)

Reduced Ethane Cracking From:
- Unscheduled Outages: 93 MBPD
- Scheduled Outages: 25 MBPD
- Delayed Expansions: 22 MBPD

This amount of ethane would have cut the surplus by ~55% and prevented the rapid rise in ethane stocks this year.
Regional Profile of Ethane Rejection

Regional Ethane Rejection - 1000 BPD (2014 1st Half)

% of regional ethane extraction capability being rejected

Nationally, about 22% of the ethane that could be extracted is being rejected.
Ethane Transportation Corridors

Vantage Pipeline: 40 to 60 MBPD of ethane. Commissioned Q1 2014.

Kinder is proposing 50 to 75 MBPD line to Windsor, Ont. – early 2018.

Mariner West: 50 MBPD of ethane. Q4-2013.

Mariner East: 40 MBPD of ethane – 2015; 70 MBPD -2016

ATEX: 125 MBPD of ethane capacity initially -- Q1 2014. Expandable to 260 MBPD.

Bakken Shale

WCSB

San Juan

Arkoma

Edmonton/ Ft. Saskatchewan

Conway

Sarnia

Mt. Belvieu

River

South Texas

Rocky Mountains

Anadarko

Arkoma

South Texas

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Enterprise export terminal at Morgan’s Point, TX
• 200 MBPD capacity.
• Q3 2016 completion.
• Evaluating expansion.
Regional Ethane Netbacks and Frac Spreads
For The Marginal Ethane Barrel

- Transportation and fractionation fees were used to calculate the netback differentials from Mt. Belvieu ethane prices.
- YTD 2014 Mt. Belvieu ethane and regional gas prices were used to calculate regional ethane frac spreads.
En*Vantage expects US ethane extraction capability to reach 2.25 MM BPD by 2020.

Some industry players are predicting US ethane extraction capability to reach 2.5 MM BPD by 2020.

But just forecasting US ethane extraction capability leaves out a very important factor in understanding S&D and pricing for ethane.
Forecast of Regional Distribution of Ethane Extraction Capability

By 2020, 1.02 MM BPD of ethane supplies will come from regions with high transportation costs to the USGC.

It is not necessary for producers in these regions to maximize ethane recoveries unless incentivized by margins.
Outlook for US Ethane Balances

MBPD

By 2020, 96% of ethane cracking will be on the Gulf Coast

* Assumes ethylene plants operate at 100% of capacity

New Plants
Conversions/Expansions/Restarts
Base C2 Cracking Capability

Max C2 Extraction
Rejection/Exports

By 2020, 96% of ethane cracking will be on the Gulf Coast
Overland Exports to Canada:

- Mariner West and Vantage pipelines deliver ethane to Nova’s ethylene plants in Sarnia, Ontario and Joffre, Alberta, respectively.
- Kinder Morgan is proposing a pipeline from the Utica to deliver ethane and EP mix to Nova in Sarnia. Open season is underway.
- Expect ethane exports to Canada to be 100 MBPD between 2015 and 2020.

Ethane Waterborne Export Terminals Being Developed:

- Sunoco Logistics – Mariner East #1 (Marcus Hook, PA) 40 MBPD of ethane export capacity -- 2015. When Mariner East #2 is completed in late 2016, Mariner East #1 should export 70 MBPD of ethane.
- Enterprise – Morgan’s Point export terminal will have an effective capacity of 200 MBPD - expected completion Q4 2016. EPD considering an expansion.
- Foreign petrochemical customers under long-term contracts with both terminals and have contracted with ethane producers.

A recent study completed by En*Vantage indicates that ethane exports could reach 270 MBPD by 2017.
Probable Distribution of Excess Ethane

Excess US Ethane Supplies
(1000 BPD)

- Ethane Rejected or Exported Overseas
- Expected Exports to Canada

Ethane Waterborne Export Capacity
Important Implications

- Ethane markets could easily get too complacent about the long-term availability of ethane supplies when the surplus peaks during the 2015 to 2016 period.
- Ethane exports will represent a major demand feature with exported ethane volumes supported by long-term supply contracts – overseas players spending a lot of $ to access US ethane.
- Very few US petrochemical companies building new ethane cracking capacity, especially on the Gulf Coast, have secured long-term ethane supplies to our knowledge.
- By 2017, US petrochemical companies will be competing for the marginal ethane barrel, which will come from transportation disadvantaged regions.
- Consequently, ethane prices and frac spreads will need to increase.
Mt. Belvieu Ethane Frac Spreads

(Mt. Belvieu Ethane Minus Henry Hub Gas)

By 2017, exports and new ethane crackers tighten ethane balances. Frac spreads increase to induce full ethane extraction in transportation disadvantaged regions.

Ethane frac spreads remain marginal through 2016.
Key Points

- Currently, surplus ethane is causing rejection of 20% to 22% (250 to 300 MBPD) of the US ethane supplies that could be extracted.
  - Rejection mostly occurring in transportation disadvantaged regions with a high degree of discretion to reject.
  - Ethylene plant outages are also aggravating the surplus of ethane.

- Growing ethane supplies will cause ethane rejection to peak at 400 MBPD (23% of US extraction capability) in the 2015 to 2016 period.
  - There is a danger that the market becomes too complacent about supplies.

- By 2017, ethane exports will play a major role along with the completion of world-scale US ethane crackers to start tightening ethane balances.
  - Export volumes under long-term contracts, whereas few US petrochemicals have secured long-term supplies.
  - Ethane frac spread will widen to justify full extraction from transportation disadvantaged regions.

- Any major delays in the completion of the world-scale ethane crackers would certainly extend the surplus of ethane.
Description of En*Vantage

- Founded by Terry Ciliske and Peter Fasullo in 1999.
- Both Principals and Consultants have over 100 combined years of experience in the energy sector.
  - Executive Management Experience in the Midstream Sector
  - Primary Focus - Natural Gas, NGLs, Refined Products and Primary Petrochemicals.
- Provide strategic planning, project due diligence, market analysis, and price risk management services to a wide range of energy companies and investment firms.
- Publish a weekly energy report -- analyzes the weekly drivers influencing natural gas, crude oil, refined products, and NGLs supply/demand and pricing.