



NGL Market Development Example

Virtual Workshop on Natural Gas Liquids

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NGL Recovery Decisions



“Must-Recover” NGLs due to sales gas specs:

- **Dewpoint** limitations. Only small amounts heavier NGLs (C4, C5+) are permitted in gas
- **Heat Value** limitation. C2, C3, C4, C5 components (in gas) have much higher heat content per unit of volume than methane (C1)

Value-Based NGL Recovery

- Type of gas processing to optimize NGL value?
- Fractionation ...local or at market destination?

NGL Recovery Decision



Dewpoint Gas Plant

- ❑ Low capital cost and operating cost
- ❑ Short lead time for construction
- ❑ No ethane recovery, good C3+ recovery

Cryogenic / Turbo-expander Gas Plant

- ❑ Higher capital cost and opex
- ❑ Longer lead time for key (stainless steel) eq.
- ❑ ~100% recovery of C3+
- ❑ ethane recovery 'configurable' up to 85%

NGL Recovery Decision



Strategy 1: Maximize NGL Value

- Build gas gathering system and gas plant
- Design plant for 'optimum' NGL recovery (dewpoint or cryogenic)
- Build fractionator and market individual products

Strategy 2: Conserve E&P Capital

- Outsource gathering and processing
- "Share" product value with midstreamer

NGL Value Driver 1: Revenue

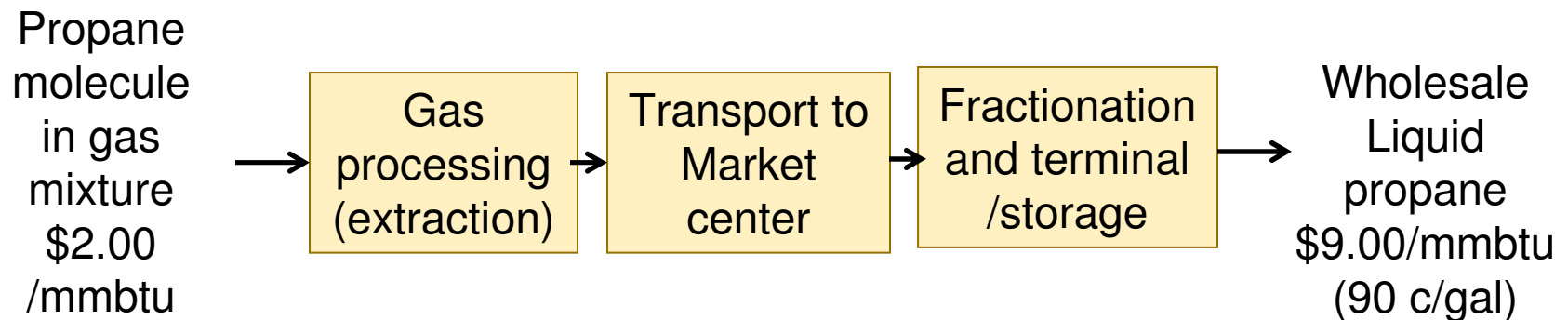


Higher market value of NGL products vs. leaving the molecules in gas. Example propane price:

90 cents per gallon = ~ **\$9.00** per mmBTU

or..

leave propane molecule in gas and get gas price.



NGL Value Driver 2: BOE



Example: 4 mmscf/d casinghead gas at typical **Bakken** composition

	gas sale mmscf/d	NGL bbl/d	BOE
Wellhead	4.0	0	667
Dewpoint plant	3.1	629	1,152
Cryo Plant	2.3	1,012	1,388

Cryo plant provides **20% uplift in BOE production /reserves** versus typical refrigeration/dewpoint plant (\$1.25 mcf in value*)

Ethane BOE is SIGNIFICANT: 10,000 bpd of crude oil might yield 10 mmscf/d raw gas and 1,000 bpd of ethane

C3, C4, C5 Value and Market



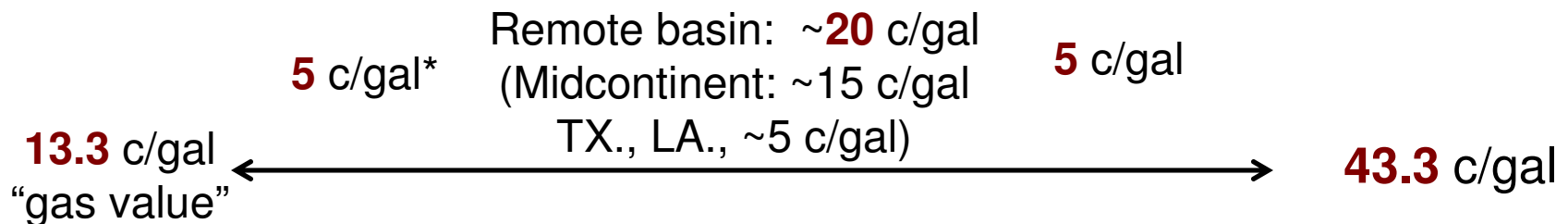
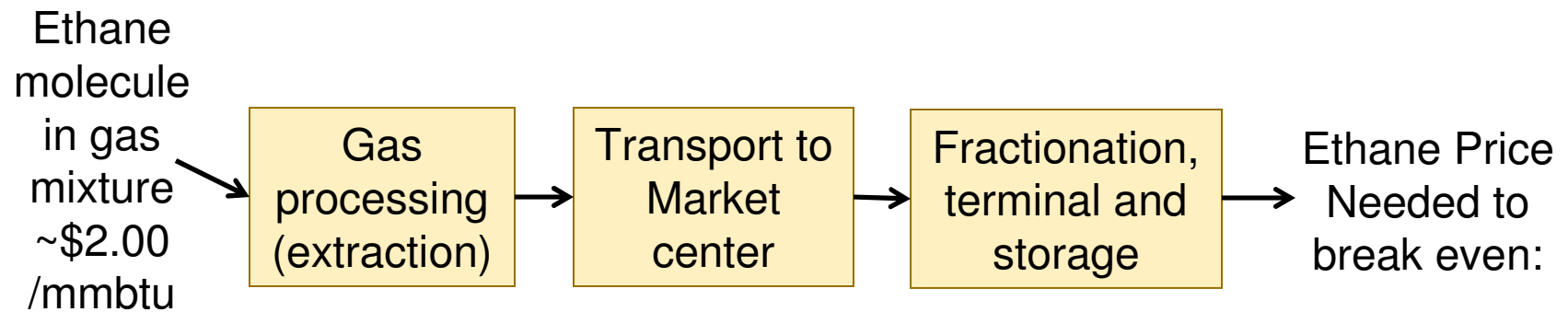
- Easy to extract C3-C4-C5 from gas with mechanical refrigeration plants.
- Variety of markets and end-users
 - Propane : heating market or pet-chem feed
 - Butane: gasoline pool or pet-chem feed
 - C5+: gasoline pool OR heavy oil diluent
- Prices tend to track %WTI, well above gas price
- Transport on pipeline, truck, rail, barge/ship
- North American surplus can be exported to world markets

Ethane is Different



1. Easy to leave it in the gas: no dewpoint impact and gas heat value spec limitation is rare.
2. Expensive to extract: Must have a cryogenic plant. (side benefit: better propane recovery)
3. Every plant must have a pipeline connection: cannot ship ethane by rail or truck
4. Only one end-use market: Pet-chem feedstock
5. Price risk: No “international” or export market. (even worse than natural gas)
6. Historically, ~40% of WTI, recently 20% of WTI

North Dakota Ethane: Evaluation of US market option



* Incremental gas processing cost attributable to ethane extraction

Recent Ethane Observations



- “Raw material” cost of ethane (at \$2 gas value) is only 30% of the breakeven price.
- The “other” 70% is the cost to extract, transport, and fractionate.
- Ethane market hub prices, May 31, 2012
 - Mont Belvieu = **27** c/gal
 - Conway = **10.5** c/gal
- Prices are well below the breakeven price(!), (were ~50c/gal higher earlier in the year.)

US Ethane in ‘remote’ basins



- Vast majority of end-users (ethane crackers) are located in gulf coast region
- “Remote basin” ethane (Marcellus, Rockies, Williston) transport distance implies significant transport cost and differential to gulf coast
- Gulf coast also getting supply / growth from more proximate sources: Barnett, Eagleford, Permian...
- ‘No export option’ means the US price is only “control” mechanism – ethane is rejected to gas

Remote Ethane Risks



A higher cost structure amplifies the price risk:

1. Remote basins are the first to go 'underwater' (below gas value) when ethane price declines
2. Take-or-pay component of long-distance ethane transport cost means transport cost is still incurred even if ethane is rejected.
3. Many plants cannot reject ethane without also rejecting some propane. Will continue to produce ethane until ethane losses exceed incremental propane value.

Ethane Market Options



- What is the nature of the ethane market in Western Canada? Who are the buyers?
- Why is Alberta an attractive market?
- What is the value proposition to North Dakota producers?
- What are the pros and cons of the Alberta ethane market compared to the U.S.?

Alberta Ethane Demand



- Four world scale ethane crackers operated by Nova Chemicals (3) and Dow Chemical (1)
- Extensive purity ethane infrastructure; 767 mile AEGS pipeline network and 5MM bbls storage
- Total ethane consumption potential in the range of 250,000 bpd (compares to ~950,000 bpd for US ethane cracker market)
- Current supply ~ 190,000 bpd on flat-line trend
- Williston ethane up to ~60,000 bpd can be absorbed in Alberta market over medium term..

Alberta Ethane Market



- Alberta ethane and petrochemical industry started in 1970's
- Ethane purchase commercial structures were “gas (BTU) value - plus” and long (~20 years) duration
- Alberta still not a “trading hub” market like Belvieu. Ethane sales prices are negotiated
- Alberta ethane buyers can potentially price on NGL basis (Belvieu or Conway) ...or ...”gas-plus” basis

U.S. Ethane Market Summary



Advantages

- Liquidity and volume of ethane market
- number of market participants
- Integrated – no need for field fractionation

Issues, Risks

- Long distance (cost) to end-user destinations
- Increasing supply effect on market balance
- Risk of ethane netback being less than gas value; negative margin or ethane rejection

Alberta Ethane Market



Advantages

- Gas-based pricing eliminates negative margin
- “No ethane rejection” reduces transport take-or-pay risk, and increases BOE prodn./reserves
- Shorter distance to market (Vantage toll: ~11c/gal)
- Demand for physical product in Alberta now

Disadvantages

- Smaller market, fewer participants
- Need to make purity ethane at plant (de-ethanizer)

Vantage Ethane Pipeline



- 430 miles: Tioga, N. Dakota to Empress, Alberta.
- 40,000 bbl/d capacity, expandable to ~60,000
- Purity ethane will be connected to Alberta Ethane Gathering system (AEGS) and delivered to petrochem buyers in Alberta
- July 2010: Press release confirms Hess Tioga as anchor supply for pipeline and Nova Chemicals as buyer.
- Target in-service date: 2Q-2013

Routing



Projected Schedule



Commercial:

- ❑ 1 additional supply deal in Saskatchewan, others under development in North Dakota

Regulatory :

- ❑ NEB approval – March 2012
- ❑ DOS approval target for August 2012

Construction:

- ❑ Commencement target for August 2012

In Service Target: July 2013
