WILL SURGING NORTH AMERICAN GAS LIQUIDS FLOOD THE WORLD?
GLOBAL HYDROCARBON SUPPLY

CRUDE/CONDENSATE
86 MM BOEPD

NATURAL GAS
56 MM BOEPD

NGLs
10 MM BOEPD

Source: KBC Energy Economics
US ENERGY PRICES RELATIVE TO WTI CRUDE OIL

2005, Shale Gas Boom: Natural Gas Disconnects First

2007, Tight Oil Growth: NGLs Move Lower

Butane
Propane
Ethane
Natural Gas

Source: KBC Energy Economics
GLOBAL IMPACT: ETHYLENE CAPACITY

Global Capacity: 156 million tpa ethylene
At risk: 14 million tpa ethylene

Criteria: Liquid feed crackers smaller than 0.5 million tpa

Source: KBC Energy Economics

October 2013
ETHANE BY SEA

Sensible If

- Existing Asset
- Coastal
- Feed starved by declining North Sea production

Four Total In Europe

- Borealis Stenungsund, Sweden
- ExxonMobil Mossmorran, UK
- INEOS Grangemouth, UK
- INEOS Bamble, Norway

INEOS building 2 LNG ships for ethane service

- Will ship **30,000 bpd** from US East Coast

**Limited** Global Opportunity
REGIONAL PROPANE PRICES

Source: KBC Energy Economics

Significant Export Incentives
US TAKES LEAD IN GLOBAL PROPANE EXPORTS

Top Propane Exporters 2013 YTD

Source: Waterborne

EPD = Enterprise Products

Source: KBC Energy Economics
PDH ATTRACTIVE FROM ALL ANGLES

Gas Production

NGL Fractionation & Storage

Steam Crackers

Propylene Derivatives

PDH

Formosa

Dow

Williams Canada

Enterprise

Export Terminals

(Neumin)

PetroLogistics

Source: KBC Energy Economics
CHINESE PROPANE DE-HYDROGENATION (PDH)

PDH Propane Consumption Capacity
000 Barrels per Day

Project Status
Construction: 9
Engineering: 2
Planning: 5
CONDENSATE: A DEFINITION

Exits wells as gas, then condenses at atmospheric temperature and pressure

Hard to track – often blended into crude oil

Like crude oil, essentially cannot be exported

Known as…
- Lease Condensate
- Very light crude oil
  - Gravity > 50° API
  - ~50% Eagle Ford Liquids Production

Similar to other hydrocarbon products that CAN be exported because they have been “processed”
- Naphtha from a refinery or condensate splitter
- Natural Gasoline from a gas plant or NGL fractionator
  - Also, known as ‘pentanes plus’
  - Also, known as ‘plant condensate’

Source: KBC Energy Economics
CONDENSATE SPLITTING

• The market is typically supply-driven, not demand led

• Key issue: will there be enough demand to match growing supply?

• Splitting condensate allows products to be exported

Crude / Condensate

LPG ~ 4%
Naphtha ~ 40%
Diesel ~ 40%
Fuel Oil ~ 16%
SO, WHY DID US SUPPLY ‘BOOM’?

Enabled by:
- 1980’s Unconventional Gas production credits
- Private mineral rights
- Infrastructure
  - Pipelines
  - Rail
  - Water
  - Gas Plants
- Geology

Unrestricted NGL exports

Restricted Crude oil exports
- Exception for foreign refineries that return refined products to US
- Limited application for Canadian refineries

Source: KBC Energy Economics
SUMMARY OF SHALE’S IMPACT

US NGL supply growth will
- Shut non-US ethylene crackers → Job Losses
- Encourage US investment/jobs → Job Gains
- Stabilize global prices → Less volatility, more certainty

Policy implications
- US exports of NGLs and petrochemicals required to clear market
- Economic drive to allow condensate exports

‘Global good’ maximized when markets are efficient
- Therefore, non-US jobs will have be lost unless…
  - Demand grows rapidly to allow incremental producers to survive
  - Governments step in and pay to support industry
- Opportunity to replicate US shale ‘boom’ globally
  - Encourage mineral rights/hydrocarbon development
  - Infrastructure investment required
  - Improved economics with open export policy
THANK YOU

Matt Kuhl
Senior Consultant
KBC Advanced Technologies
kuhlm@kbcat.com
(281) 597-7973
WHAT ARE NGLS; SOURCES AND USES

Natural Gas

Mixed NGLs (y-grade)

NGL Fractionator

Gas Plant

Ethane (C2)

Propane (C3)

Butane (C4)

Natural Gasoline (C5+)

“Wet” Gas
79% from Gas Wells
21% from Oil Wells

Refinery Supply

Only Upgrade Option

• Plastics
• Home Heating
• Motor Gasoline
• Rubber
• Heavy Oil Diluent

Source: KBC Energy Economics
WHAT HAPPENED IN THE US

US NGL Supply Growth

Source: KBC Energy Economics
US ECONOMIC IMPACTS

Midstream Infrastructure
- Pipelines
- Rail/truck facilities
- Gas plants
- NGL fractionators
- Export terminals

Ethane Crackers for Ethylene Production
- Ethylene derivative plants
- Product manufacturing plants

PDH plants for Propylene Production
- Propylene derivative plants
- Product manufacturing plants
EVERY DARK CLOUD HAS A SILVER LINING

Naphtha co-products short in US
- Butadiene for plastic/rubber
- Aromatics for polymers/fiber

Creates opportunity abroad
- Globally, most ethylene capacity additions will continue to be based on naphtha feedstock
- Middle East will increasingly shift away from ethane to heavier feeds due to lack of ethane supply growth