Midstream 101: What does “Midstream” mean?
Midstream 101: What does “Midstream” mean?
Midstream is the conduit between Upstream and Downstream. – STI Group

Midstream is a term used to describe one of the three major stages of oil and gas industry operations. Midstream activities include the treating, processing, storing, transporting and marketing of oil, natural gas, natural gas liquids and their contaminants or byproducts. The other major stages are upstream, which refers to raw crude oil and natural gas production, and downstream, which refers to the refining of crude oil into gasoline, diesel, jet and other fuels or in the case of natural gas, the petrochemical industry that converts NGLs into the building blocks for a myriad of everyday products. - Investopedia
Midstream 101: Summary

Where/Why is Midstream?

Who is Midstream?

What is Midstream?
- Water
- Oil
- Gas

Questions?
The Midstream: Where/Why?

Lower 48 states shale plays

(Credit: Energy Information Administration - EIA)
Midstream 101: Where/Why?

Natural Gas Liquids
Major NGL Pipelines

(Source: Encana)
Midstream 101: Who?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company Name</th>
<th>2017 EBITDA</th>
<th>% Change</th>
<th>2016 EBITDA</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enbridge Inc. (ENG)</td>
<td>$5,215</td>
<td>63%</td>
<td>$3,218</td>
<td>31%</td>
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<tr>
<td>2</td>
<td>Energy Transfer (ET)</td>
<td>$3,218</td>
<td>32%</td>
<td>$2,435</td>
<td>13%</td>
</tr>
<tr>
<td>3</td>
<td>Kinder Morgan Inc. (KMI)</td>
<td>$2,435</td>
<td>2%</td>
<td>$2,435</td>
<td>2%</td>
</tr>
<tr>
<td>4</td>
<td>TransCanada Corp. (TRP)</td>
<td>$2,100</td>
<td>4%</td>
<td>$2,000</td>
<td>8%</td>
</tr>
<tr>
<td>5</td>
<td>Enterprise Products Partners (EDP)</td>
<td>$2,100</td>
<td>8%</td>
<td>$2,000</td>
<td>8%</td>
</tr>
<tr>
<td>6</td>
<td>Williams Cos. (WMB)</td>
<td>$2,100</td>
<td>3%</td>
<td>$2,100</td>
<td>3%</td>
</tr>
<tr>
<td>7</td>
<td>Plains All American (PAGP)</td>
<td>$2,100</td>
<td>6%</td>
<td>$2,100</td>
<td>6%</td>
</tr>
<tr>
<td>8</td>
<td>MPLX (MPLX)</td>
<td>$2,100</td>
<td>10%</td>
<td>$2,100</td>
<td>10%</td>
</tr>
<tr>
<td>9</td>
<td>ONEOK Inc (OKE_)</td>
<td>$2,100</td>
<td>10%</td>
<td>$2,100</td>
<td>10%</td>
</tr>
<tr>
<td>10</td>
<td>Cheniere Energy Inc. (LNG)</td>
<td>$2,100</td>
<td>10%</td>
<td>$2,100</td>
<td>10%</td>
</tr>
</tbody>
</table>

Source: Exterran Corporation

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Midstream 101: Who?

Private Equity Midstream Companies

- Tall Oak
- Lucid
- M3
- Brazos
- Eagle Claw
- Caiman
- Intensity
- Velocity
- Howard Energy
- Outrigger
Midstream 101: What do they do?

• Gathering
• Processing
• Storing
• Transporting
• Marketing

(Source: Tall Oak Midstream)
Midstream 101: Oil, Gas, Water PFD

(Source: Black Canyon Midstream)
Midstream Value Chain: Separation
Midstream 101: Saltwater Disposal Well

(Source: http://www.chriswellconsulting.com/water-management.html)
REVOLIFT® VS Flotation

- Fully Enclosed, Multi-Chambered
- Full PLC and ESD
- Portable
- NACE (Sour Service)
- Blanketed System
- Class 1 Div 2
- 0 – 30,000 BWPD
- Upset tolerant
- Low install costs
- Lower chemical costs
Midstream 101: Exterran REVOLIFT Results

<table>
<thead>
<tr>
<th>Inlet Oil PPM</th>
<th>Outlet Oil PPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>493</td>
<td>24</td>
</tr>
<tr>
<td>520</td>
<td>21</td>
</tr>
<tr>
<td>511</td>
<td>25</td>
</tr>
<tr>
<td>596</td>
<td>33</td>
</tr>
<tr>
<td>522</td>
<td>12</td>
</tr>
<tr>
<td>498</td>
<td>29</td>
</tr>
<tr>
<td>529</td>
<td>10</td>
</tr>
<tr>
<td>335</td>
<td>10</td>
</tr>
<tr>
<td>609</td>
<td>14</td>
</tr>
</tbody>
</table>

Before Revolift VS

After Revolift VS and Bag Filter

Before Revolift VS

After Revolift VS
Midstream 101: Oil
Midstream 101: Oil PFD
Midstream 101: Oil Gathering
Midstream 101: Oil Transportation

(Source: Enbridge)

(Source: Forbes)

(Source: Businessinsider.com)
Operable refinery locations and capacity volumes as of January 1, 2012

PADD 1: East Coast

PADD 2: Midwest

PADD 3: Gulf Coast

PADD 4: Rocky Mountain

PADD 5: West Coast

oil refinery capacity
thousand barrels per day

- 250 and above
- 110 to 250
- 50 to 110
- less than 50
Midstream 101: Natural Gas

Upstream Production → Gas Gathering → Processing Plant → Midstream → Interstate Pipelines → City Gates

RAW NGL Mix → Fractionator

- Ethane
- Propane
- Normal Butane
- Isobutane
- Natural Gasoline

Finished NGLs

- Petrochemical Industry
- Refineries
- Industrial/Heating
Midstream 101: Pipeliners

(Source: Phillips 66 Partners)
# Midstream 101: Natural Gas Processing

## Chart

![Temperature Chart](image)

<table>
<thead>
<tr>
<th>Process</th>
<th>Product / Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>J.T.</td>
<td>Gas Fuel Conditioning</td>
</tr>
<tr>
<td>Mechanical Refrigeration</td>
<td>Dew point Control Natural Gas Liquid - NGL</td>
</tr>
<tr>
<td>Cryogenic</td>
<td>Liquefied Petroleum Gas – LPG</td>
</tr>
<tr>
<td>Cryo w/ Mech. Refrigeration.</td>
<td>High recovery of rich gas</td>
</tr>
<tr>
<td>LNG Process</td>
<td>Liquefied Natural Gas - LNG</td>
</tr>
</tbody>
</table>

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Midstream 101: Why?

A. **Inlet Gas Composition**

<table>
<thead>
<tr>
<th>Component</th>
<th>Mole % (Dry Basis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>0.916</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>0.530</td>
</tr>
<tr>
<td>Methane</td>
<td>76.421</td>
</tr>
<tr>
<td>Ethane</td>
<td>11.282</td>
</tr>
<tr>
<td>Propane</td>
<td>6.280</td>
</tr>
<tr>
<td>n-Butane</td>
<td>2.216</td>
</tr>
<tr>
<td>i-Butane</td>
<td>0.729</td>
</tr>
<tr>
<td>n-Pentane</td>
<td>0.442</td>
</tr>
<tr>
<td>i-Pentane</td>
<td>0.590</td>
</tr>
<tr>
<td>n-Hexane</td>
<td>0.346</td>
</tr>
<tr>
<td>n-Heptane</td>
<td>0.196</td>
</tr>
<tr>
<td>n-Octane</td>
<td>0.052</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
</tr>
</tbody>
</table>

- **Contaminates**
- **Natural Gas**
- **Natural Gas Liquids or NGLs**
- **Natural Gasoline or Condensate**

**One Example**

<table>
<thead>
<tr>
<th>Specifications for Pipeline Quality Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Components</strong></td>
</tr>
<tr>
<td>Methane</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>Ethane</td>
</tr>
<tr>
<td>Propane</td>
</tr>
<tr>
<td>Butanes</td>
</tr>
<tr>
<td>Pentanes and heavier</td>
</tr>
<tr>
<td>Butanes</td>
</tr>
<tr>
<td>Nitrogen and other inerts</td>
</tr>
<tr>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>Total diluent gases</td>
</tr>
<tr>
<td>Natural Gas</td>
</tr>
<tr>
<td>Trace components</td>
</tr>
</tbody>
</table>

- **Contaminates**

- **C2+ Content** = 6.30 GPM
- **Water Content** = 15 lb H2O/MMscf
- **Mercury (Hg) Content** = Nil

- **Heating Value** = 1297 Btu/SCF

**Heat content**
Amine Plant
Removes CO2 or H2S compounds
Midstream 101: Treating PFD

Standard Amine Plant Process Flow Diagram

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Midstream 101: Gas Processing

Cryogenic, Natural Gas Processing Plant

Separates NGLs from Methane and/or Ethane to form Pipeline Quality Gas and a Y-Grade liquid product
Midstream 101: Gas Processing PFD
Midstream Value Chain: Fractionation

- Feed from Extraction Unit
- Deethanizer
- DePROPANIZER
- DEBUTANIZER
- BUTANE SPLITTER
- Chiller
- Ethane
- Propane
- Iso-butane
- Normal butane
- C5+ product
Midstream 101: Natural Gas Storage

(Source: MPLX)
Midstream 101: Natural Gas Storage

Storage in Salt Caverns

Type of Facility:
Storage in Salt Caverns

Specifications:
- Smaller working gas capacity
- High deliverability

1) Gas plant
2) Storage well
3) Salt cavern
4) Salt dome formation

(Source: Storengy)
Midstream 101: Petrochemicals, or End Use
Midstream 101: Midstream brings value
CURIOSITY
We are inquisitive because we want to learn and grow.

Your Questions
The Midstream: Gathering

“Upstream” ➔ “Downstream”
- **Upstream**
  - Drilling
  - Production

- **Midstream**
  - Transportation
  - Treatment

- **Downstream**
  - Industrial
  - Residential
  - Commercial
Midstream 101: Well Injection below water table

Hydraulic Fracturing Water Cycle

Water Cycle Stages:
- Water Acquisition
- Chemical Mixing
- Well Injection
- Flowback and Produced Water
- Wastewater Treatment and Waste Disposal

EPA (United States Environmental Protection Agency)
• Cooler
• Driver - (engine)
• Compressor
• Process piping and vessels
• Controls
• Skid