Midstream 101
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Exterran Corporation
October 3, 2019
Midstream 101: Definition

**Midstream** – 1 of 3 major stages of Oil & Gas industry operations. Activities include treating, processing, storing, transporting and marketing of oil, natural gas, natural gas liquids (NGLs) and their contaminants or byproducts.

Other major O&G segments include:

- **Upstream** - raw crude oil and natural gas exploration & production (E&P)
- **Downstream** - refining of crude oil into gasoline, diesel, jet and other fuels or for natural gas, the petrochemical industry that converts NGLs into building blocks for a myriad of everyday products. - Investopedia

![Diagram of Oil & Gas Industry Stages](image-url)
Where / Why is Midstream?

Who is Midstream?

What is Midstream?
- Water
- Oil
- Gas

Questions?
The Midstream: Where / Why?

Lower 48 states shale plays

(Source: Energy Information Association – EIA January 2015)
The Midstream: Transportation

“Upstream”

“Downstream”

(Source: Energy Information Association - EIA)
## Midstream 101: Who?

### Top 15 O&G Storage & Transport Cos. – Platts (assets, revenue, profit, ROIC)

<table>
<thead>
<tr>
<th>Platts Rank</th>
<th>Company Name</th>
<th>Region</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>OJSC Transneft</td>
<td>EMEA</td>
<td>Oil and Gas Storage and Transportation</td>
</tr>
<tr>
<td>61</td>
<td>The Williams Companies, Inc</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
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<tr>
<td>63</td>
<td>Enbridge Inc</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
</tr>
<tr>
<td>66</td>
<td>TransCanada Corp</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
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<tr>
<td>98</td>
<td>Kunlun Energy Co Ltd</td>
<td>Asia/Pacific</td>
<td>Oil and Gas Storage and Transportation</td>
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<tr>
<td>124</td>
<td>Snam S.p.A.</td>
<td>EMEA</td>
<td>Oil and Gas Storage and Transportation</td>
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<tr>
<td>127</td>
<td>Ultrapar Participações SA</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
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<tr>
<td>151</td>
<td>Pembina Pipeline Corp</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
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<td>155</td>
<td>ONEOK, Inc</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
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<td>172</td>
<td>Kinder Morgan, Inc</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
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<tr>
<td>182</td>
<td>Enagás, SA</td>
<td>EMEA</td>
<td>Oil and Gas Storage and Transportation</td>
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<tr>
<td>193</td>
<td>Inter Pipeline Ltd</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
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<tr>
<td>223</td>
<td>EnLink Midstream, LLC</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
</tr>
<tr>
<td>242</td>
<td>Cheniere Energy, Inc</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
</tr>
<tr>
<td>246</td>
<td>Targa Resources Corp</td>
<td>Americas</td>
<td>Oil and Gas Storage and Transportation</td>
</tr>
</tbody>
</table>
Midstream 101: Who?

**Private Equity Midstream Companies (US)**

*Sponsors:* Blackrock, Apollo, ArcLight, Riverstone, EnCap, Morgan Stanley, ECP, etc.

- Tall Oak
- Lucid Energy Group
- Oryx Midstream
- Brazos Midstream
- Eagle Claw Midstream
- Caiman Energy
- Intensity Midstream
- Velocity Midstream
- Valiant Midstream
- Outrigger Energy
- Fullstream Energy
- Howard Energy Partners
- Sendero Midstream
- Navitas Midstream

...plus the Majors

- Shell
- Chevron
- Oxy
- BP
- XOM / XTO
  - …
Midstream 101: We have some work to do…

- Gather
- Dispose / Re-use
- Compress
- Treat / Process
- Store
- Transport
- Market
The Midstream: Gathering

“Upstream”

“Downstream”

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Midstream Value Chain: Separation

Wellhead → Heater-Treater → Tank

- Gas to Sales
- Vent
- to Atmosphere
- to Flare
- to Combustor
- to Vapor Recovery Unit

Oil & Gas → Water
Midstream 101: Water
Midstream 101: Water

(©Hart Energy, source: Gravity Oilfield Services)
Midstream 101: Saltwater Disposal (SWD) Well

(Source: http://www.chriswellconsulting.com/water-management.html)
Midstream 101: Water
Midstream 101: Exterran REVOLIFT Results

Key Benefits:
- 0 – 30,000 BPD
- Fully enclosed
- Multi-chambered
- Full PLC & ESD
- Portable
- NACE (sour service)
- Blanketed system
- Class 1 Div 2
- Upset tolerant
- Low install cost
- Lower chemical cost
Midstream 101: Oil
Midstream 101: Oil
Midstream 101: Oil Storage
Midstream 101: Oil Transportation

(Source: Enbridge)

(Source: Forbes)

(Source: Businessinsider.com)

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Midstream 101: Gas Gathering

(Source: SNC Lavalin)
Midstream 101: Pipeliners

(Source: Phillips 66 Partners)
Midstream 101: Compression
Midstream 101: Why?

“Upstream”

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>
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<tr>
<td>Ethane</td>
<td>11.282</td>
</tr>
<tr>
<td>Propane</td>
<td>6.280</td>
</tr>
<tr>
<td>i-Butane</td>
<td>0.729</td>
</tr>
<tr>
<td>n-Butane</td>
<td>2.216</td>
</tr>
<tr>
<td>i-Pentane</td>
<td>0.442</td>
</tr>
<tr>
<td>n-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>

“Downstream”

Contaminants

“Natural Gas”

Natural Gas Liquids or NGLs

Natural Gasoline or Condensate

Contaminants

One Example

Specifications for Pipeline Quality Gas

Major Components

- Methane: Minimum Mol% 75, Maximum Mol% None
- Ethane: Minimum Mol% None, Maximum Mol% 10
- Propane: Minimum Mol% None, Maximum Mol% 5
- Butanes: Minimum Mol% None, Maximum Mol% 2
- Pentanes and heavier: Minimum Mol% None, Maximum Mol% 0.5
- Nitrogen and other inerts: Minimum Mol% None, Maximum Mol% 3
- Carbon dioxide: Minimum Mol% None, Maximum Mol% 2–3
- Total diluent gases: Minimum Mol% None, Maximum Mol% 4–5

Trace components

- Hydrogen sulfide: 0.25–0.3 g/100 scf (6–7 mg/m³)
- Total sulfur: 5–20 g/100 scf (115–460 mg/m³)
- Water vapor: 4.0–7.0 lb/MMscf (60–110 mg/m³)
- Oxygen: 1.0%

Other characteristics

- Heating value (gross, saturated): 950–1,150 Btu/scf (35,400–42,800 kJ/m³)
- Liquids: Free of liquid water and hydrocarbons at delivery temperature and pressure
- Solids: Free of particulates in amounts deleterious

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

Heating Value = 1297 Btu/SCF

Heat content

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<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>

- **C$_5$ Pentane**
- **C$_4$ Butane**
- **C$_3$ Propane**
- **C$_2$ Ethane**
- **C$_1$ Methane**
Amine Plant
Removes CO2 & H2S compounds
Midstream 101: Gas Processing

Cryogenic Natural Gas Processing Plants

Separate NGLs from Methane and/or Ethane to get pipeline quality NG & Y-grade liquids … or more…
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: MPLX)
Midstream 101: Petrochemicals, or End Use
Midstream 101: Midstream brings value