Natural Gas Basics

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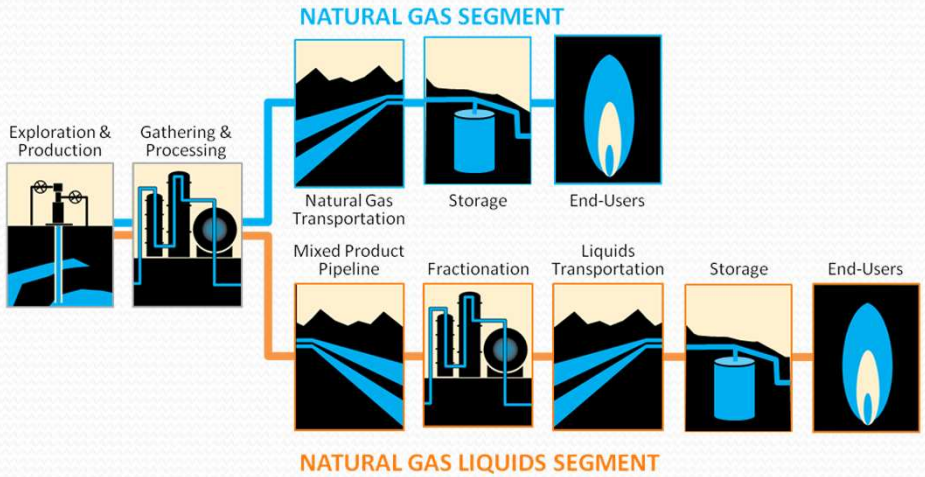
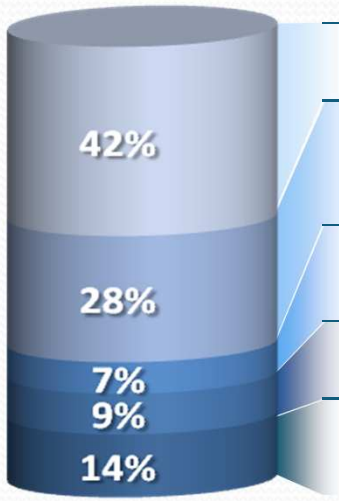
Natural Gas Liquids 101



Processing & Fractionation

- **Processing plants** use several different methods to cool high-BTU ("liquids rich") gas in order to condense or separate the raw mix NGLs out of the gas stream
- **Fractionators** split raw mix NGLs by regulating temperatures and pressures in a sequence of towers to produce individual products *(ethane, propane, normal butane, iso-butane, natural gasoline)*

Processed U.S. NGL barrel



Fractionated Products & Uses

Ethane (C_2): Petrochemicals

Propane (C_3): Petrochemicals; heating; exports

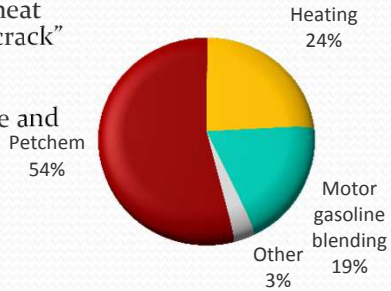
Normal butane (nC_4): Petrochemicals; motor gasoline blending; exports

Iso-butane (iC_4): Motor gasoline blending

Natural gasoline (C_{5+}): Petrochemicals; motor gasoline blending; exports

Major U.S. NGL Demand Sources

- **Petrochemical**
  - Petrochemical plants apply heat and pressure to convert or "crack" NGLs to make a variety of building block chemicals: ethylene, propylene, benzene and butadiene
- **Heating**
  - Weather dependent, highly seasonal
- **Motor gasoline blending**
  - Experiences high seasonality as warm temperatures make butane too combustible



Natural Gas: Value Chain

Exploration
Uses various techniques to find new oil and gas resources

Production
Exploits newly found resources, brings the hydrocarbons to the surface

Processing
Treats hydrocarbons so that they can be sent to downstream operations or market

Transportation
Moves hydrocarbons via pipelines and/or tankers

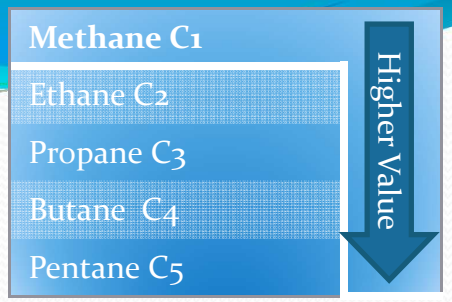
Marketing
Distributing and selling hydrocarbons

Upstream E&P

Midstream

Downstream

Natural Gas: Basics



- Natural gas is a naturally occurring mixture comprised mainly of methane (CH_4), with varying amounts of heavier hydrocarbons such as ethane, propane, butane and pentanes (also known as natural gas liquids or NGLs). This mixture often contains other non-hydrocarbon substances such as carbon dioxide, nitrogen, sulphur and/or helium.
- Both NGLs and non-hydrocarbons are stripped from the methane at gas processing plants prior to its transportation and sale to end users with the NGLs also being sold for commercial use.
- Natural gas is often found in conjunction with oil and referred to as "associated gas," while "non-associated gas" accumulates on its own.

- Source RBC: Energy made Simple

Natural Gas uses and benefits

- Natural gas is clean burning and found in every part of our life. Applications include:
  - Power Generation, Heating, Cooking, Fertilizers, Petrochemicals, Plastics …
- Natural gas has the least emissions of all hydrocarbons:
  - Lowest CO_2 per unit of energy than oil and coal

Natural Gas: access to markets

- Natural Gas is a regional commodity. Unlike crude oil, natural gas prices are mainly determined by regional market forces due to the difficulty of storing or transporting natural gas by vehicle.
- Natural gas is primarily shipped by pipelines, across land and under water. But this impractical across oceans.
- Natural gas must be transformed into Liquefied Natural Gas (LNG) before being transported across long distances by tankers, and then re-gasified at its destination.
- This inability to easily transport natural gas over long distances explains the disconnect between gas prices in different parts of the world (i.e., Asia vs. North America).
- The factors affecting pricing are similar to those affecting the globally priced crude oil: cost of extraction, distance between markets and producing areas, transportation charges, pipeline capacity, cost of competing energy sources, regional demand changes due to weather extremes, and overall balance between continental supply and demand.

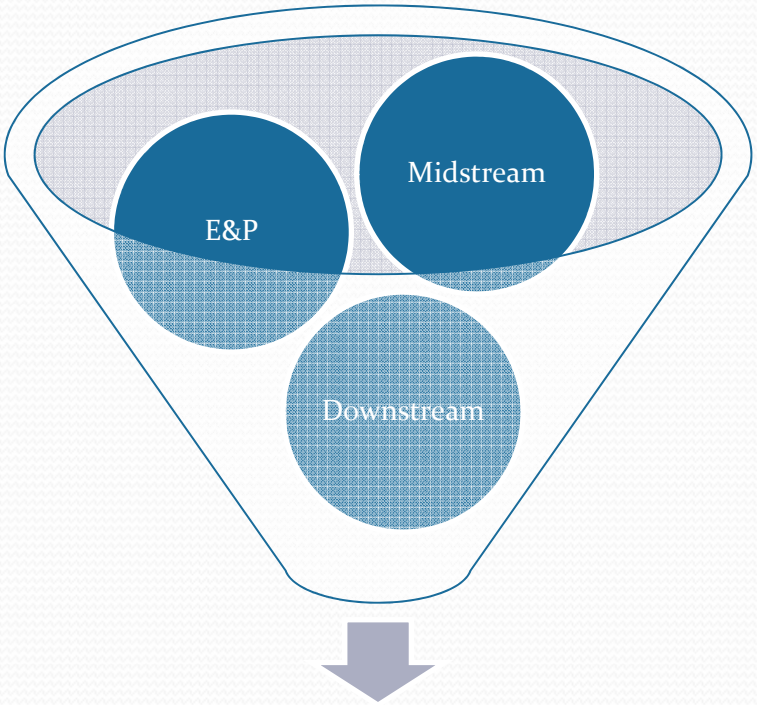
Natural Gas Liquids (NGLs)

- Natural gas with high levels of NGL content is referred to as “liquids-rich” or “wet” natural gas.
- Many companies are increasingly targeting liquids-rich natural gas plays, which offer higher priced NGLs that can be sold in addition to the dry gas.
- NGLs have widespread uses as fuels for both heating and motor vehicles, and are also sources of feedstock for both petrochemicals and crude oil refining.

Benefits to Lebanon

- New industry - diversifies dependence on current industries
- Economic uplift
- Good paying jobs for Lebanese, in Lebanon
- Multiplier economic effect
- Energy independence

Investment opportunities



Multiple investment opportunities

Risks

- Environmental
- Recoverable reserves
- Political and regulatory stability
- Security
- Process clarity and transparency

About the author

- Elie G. Atme received a Bachelor degree in mechanical engineering from McMaster University in Hamilton, Ontario and, a Master of Business Administration degree from Rice University in Houston. He is a licensed professional engineer in Ontario.
- Mr. Atme has about 20 years of experience in the energy and petrochemical industries. He has developed multiple projects serving oil and gas markets, and petrochemical plants.
- Mr. Atme is an independent contributor to MESP.