TXOGA

TEXAS OIL & GAS ASSOCIATION | SINCE 1919

Defining the Industry Supply Chain

Presented by

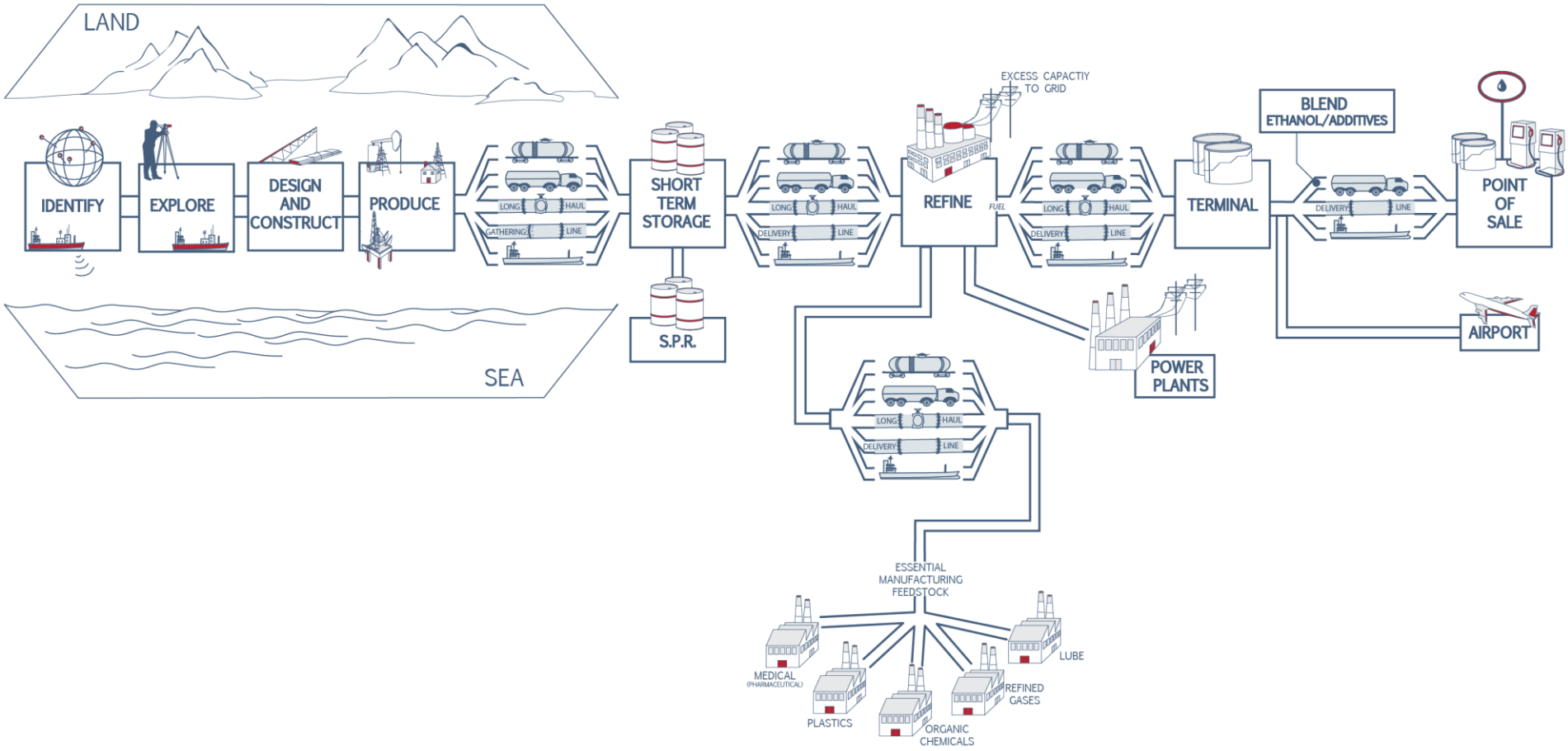
Ben Sebree

- Our goal is to raise the level of awareness around the oil supply chain among key stakeholders in order to facilitate positive working relationships and more informed decision making.

- We've built resiliency and rapid response capabilities into our supply chain to prevent incidents and to ensure that, if events occur, they produce the least possible impact.

Oil Supply Chain

CRITICAL ELEMENTS OF THE OIL SUPPLY CHAIN



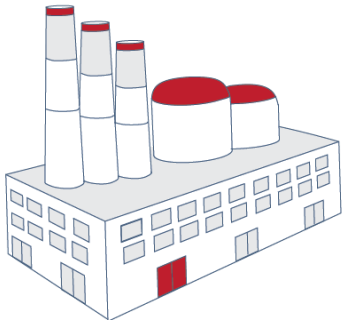
Legend:
S.P.R.: Strategic Petroleum Reserve

RESOURCES: PEOPLE (HUMAN BEHAVIOR, SKILLED/TRAINED PERSONNEL) | POWER (ELECTRICITY) | WATER | IT (TELECOM, CYBER, ACCESS CONTROL)

UNDERTANDING THE COMPONENTS

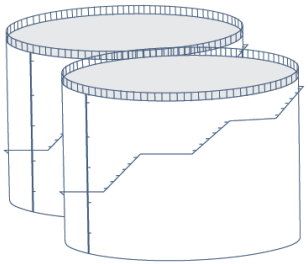
PRODUCTION

PIPELINES



REFINING

SHORT TERM STORAGE

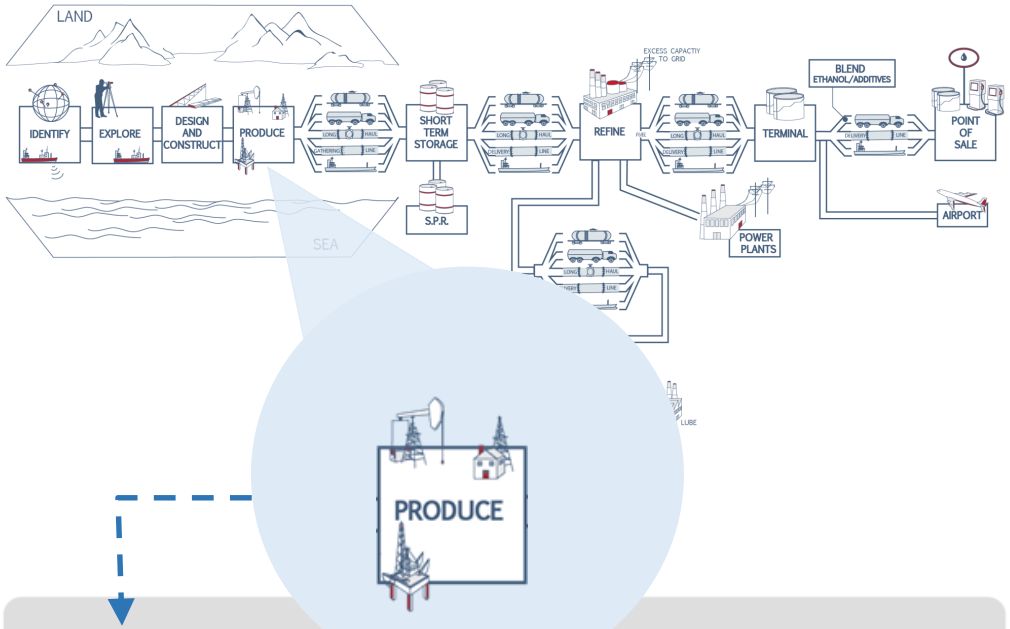


TERMINAL

SHIPPING & PORTS OF CALL

POINT OF SALE

OIL PRODUCTION



OVERVIEW

The first step in the oil supply chain is production. During production, crude oil is produced on both land and at sea. Oil production includes drilling, extraction, and recovery of oil from underground.

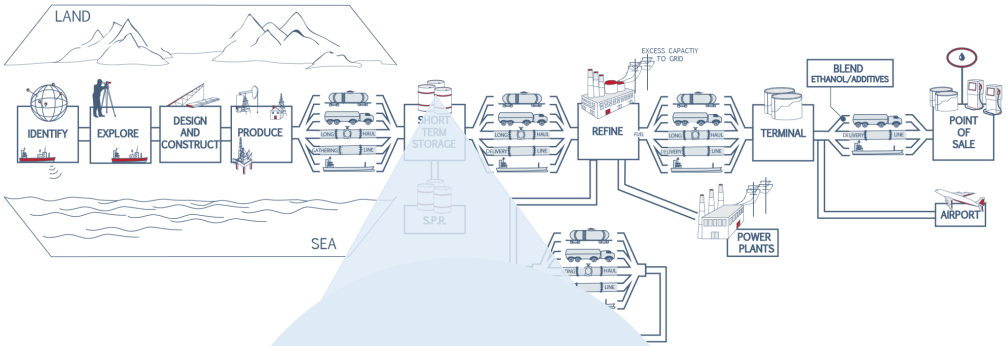
STATISTICS

- U.S. production reached more than 2.3 billion barrels per year in 2012.
- Crude oil production has increased since 2008, reversing a decline that began in 1986.
- From 5.0 million barrels per day in 2008, U.S. crude oil production increased to 6.5 million barrels per day in 2012.

KEY TAKEAWAY

Improvements in advanced crude oil production technologies continues to lift domestic supply. The projected growth results largely from a significant increase in onshore crude oil production, particularly from shale and other tight formations, which has been spurred by technological advances and relatively high oil prices.

OIL SHORT TERM STORAGE



OVERVIEW

Short term storage serves as the staging area for crude distribution throughout the entire supply chain. Without storage facilities, the ability to adjust to supply and demand would be debilitated.

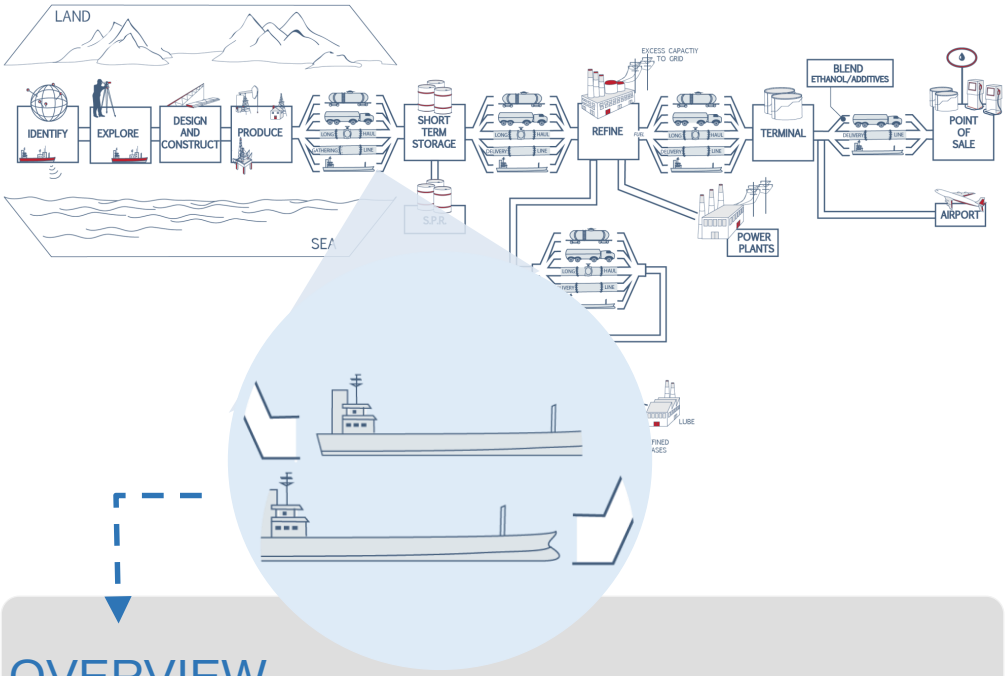
STATISTICS

- The U.S. has 615 million barrels of storage capacity at refineries.
- The U.S. has 950 million barrels of storage capacity at bulk terminals.
- 89 million barrels can be stored in the product pipeline system.

KEY TAKEAWAY

Underground moisture can corrode steel tanks. New fiberglass tanks and steel tanks lined with fiberglass or other durable, coatings help prevent corrosion. The same high-tech coatings and linings also protect the Nation's pipelines and above-ground storage tanks.

SHIPPING OIL



OVERVIEW

Ports of call represent the major entrance and exit points of crude oil prior to short term storage and, later, refining. Ports serve as central gathering facilities for entrance into the U.S.

Shipping channels are the most travelled and commonly used source to move foreign oil to domestic refineries. Large tankers contain thousands of barrels of crude oil to be refined into fuel and other by-products.

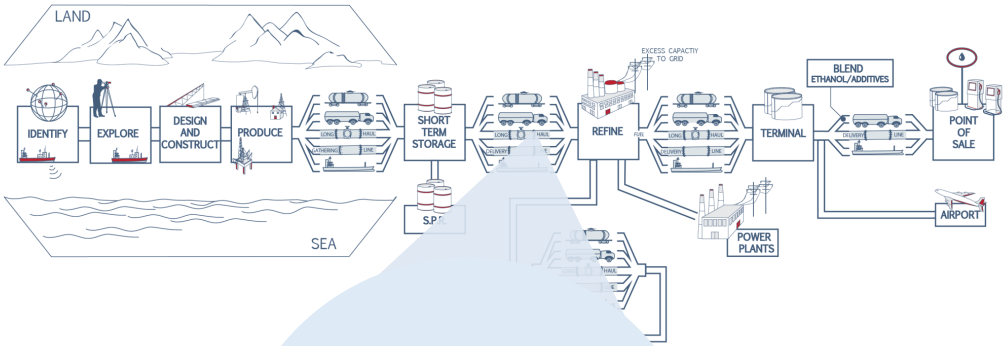
STATISTICS

- In 2012, the U.S. exported 1.2 billion barrels of crude oil.
- In 2012, the U.S. imported almost 7.4 billion barrels of petroleum products.
- Of the $2.6 trillion in total trade (which includes imports and exports) transported via US transportation infrastructure, maritime transportation, including ports, is a large part of this, responsible for roughly $1.8 trillion.

KEY TAKEAWAY

One tanker can carry 320,000 barrels of gasoline. This is approximately the equivalent capacity of 12 tank barges, 552 rail cars, or 1,728 trucks, and would keep about 30,000 cars running for around a year.

PIPELINES



OVERVIEW

Gathering pipelines are the main transportation modes for movement of crude oil into short term storage. Gathering pipelines travel shorter distances than long haul pipelines, varying in size, frequency, and flow levels.

Delivery lines act as a major transportation module of crude oil to the refining process. Delivery lines are smaller in diameter and travel shorter distances than gathering lines.

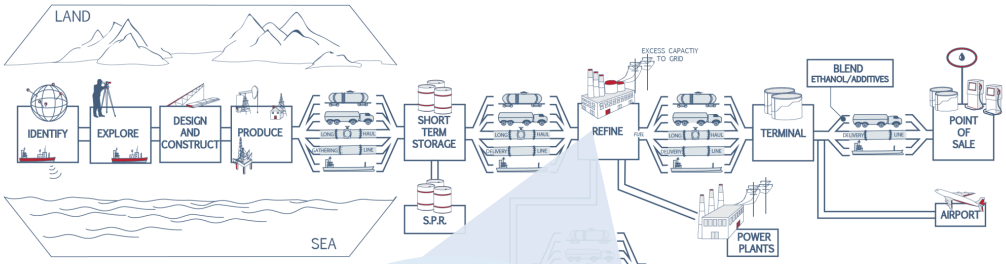
STATISTICS

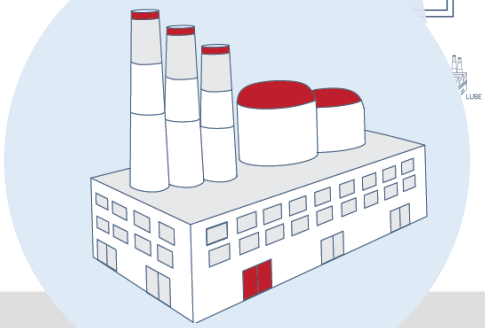
- There are approximately 55,000 miles of crude oil trunk lines in the U.S.
- Pipelines move nearly two-thirds of the oil and petroleum products transported annually.
- Replacing even a modest-sized pipeline, which might transport 150,000 barrels per day, would require 750 tanker truck loads per day, a load delivered every two minutes around the clock.

KEY TAKEAWAY

Interstate pipelines deliver over 11.3 billion barrels of petroleum each year. (There are 42 gallons in a barrel.) About 52% of the petroleum transported by pipelines is crude oil and 47% is in the form of refined petroleum products.

REFINERY





OVERVIEW

Refineries act as the main transformation point for all crude oil into its various consumable products and are mainly located domestically. After receiving oil from storage facilities, refineries use various chemical separation and reaction processes to transform crude oil into usable products such as: fuel oil, diesel oil, jet fuel, and multiple essential manufacturing feedstocks.

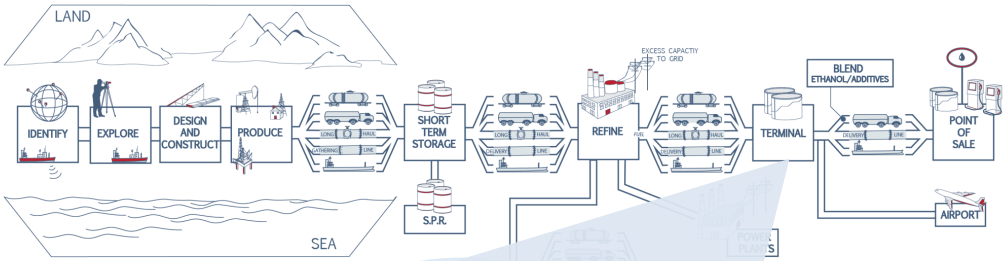
STATISTICS

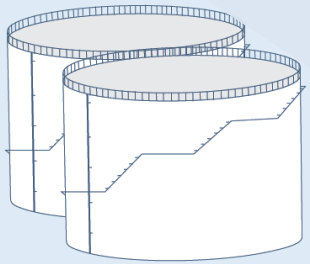
- 143 refineries in the United States
- In 2012, U.S. refineries produced over 3.2 billion barrels of finished motor gasoline.

KEY TAKEAWAY

Even though no new refineries have been built since the 1970s, industry advancements have vastly boosted refining capacity—adding the capacity of 23 average-size facilities to existing refineries.

TERMINAL





OVERVIEW

Refined fuel that is ready for use is transported to terminals. Terminals are located closer to transportation hubs and are the final staging point for the refined fuel before the point of sale. After entering the terminal ethanols and additives are added to the final refined product before fuel is transported.

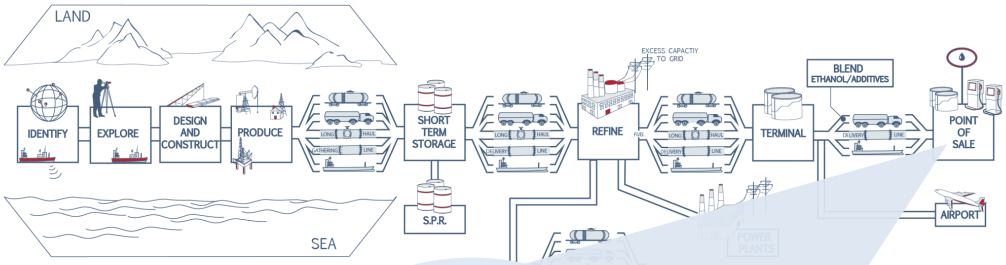
STATISTICS

- 1537 petroleum product terminals in the U.S.

KEY TAKEAWAY

Terminals are owned by individual petroleum marketers, by common carrier pipeline/terminal companies or by integrated oil companies. As a result, fuels supplies that are available in excess of that needed to meet contractual obligations are treated as a surplus and sold at a discount. In a shortage, contractual needs are served first and there is little or no surplus. Hence, vendors who rely solely on the spot market may be unable to supply critical needs customers during a shortage.

POINT OF SALE



OVERVIEW

Once the refined fuel leaves the terminal, it is transported to its final point of sale, which includes fuel stations and airports. The trucking, shipping and delivery lines provide the final finished product which can be delivered across the country.

STATISTICS

- America's 180,000 retail service stations hold over 2 billion gallons of gasoline and diesel fuel at any given time.
- A typical gasoline station has a storage capacity of 30,000 to 40,000 gallons.

KEY TAKEAWAY

Major integrated oil companies only own about 3 percent of retail stations. A little known fact is that the vast majority of branded stations are owned and operated by independent retailers who are licensed to represent that brand..

Natural Gas Supply Chain

REDUNDANCY AND RESILIENCY IN THE SYSTEM

- Redundancy within the US natural gas supply chain enables critical components to continue to operate in case of disruptions to the system. Examples include:
  - Over 500 natural gas processing plants
  - Over 305,000 miles of natural gas pipeline
  - Over 30 major market hubs
  - Over 400 storage facilities

- The US natural gas supply chain is inherently resilient as a result of its design, which incorporates rapid response capabilities with automatic response triggers.

- The redundancy of components and the resiliency of the system design inhibit traditional chokepoints in the natural gas supply chain.

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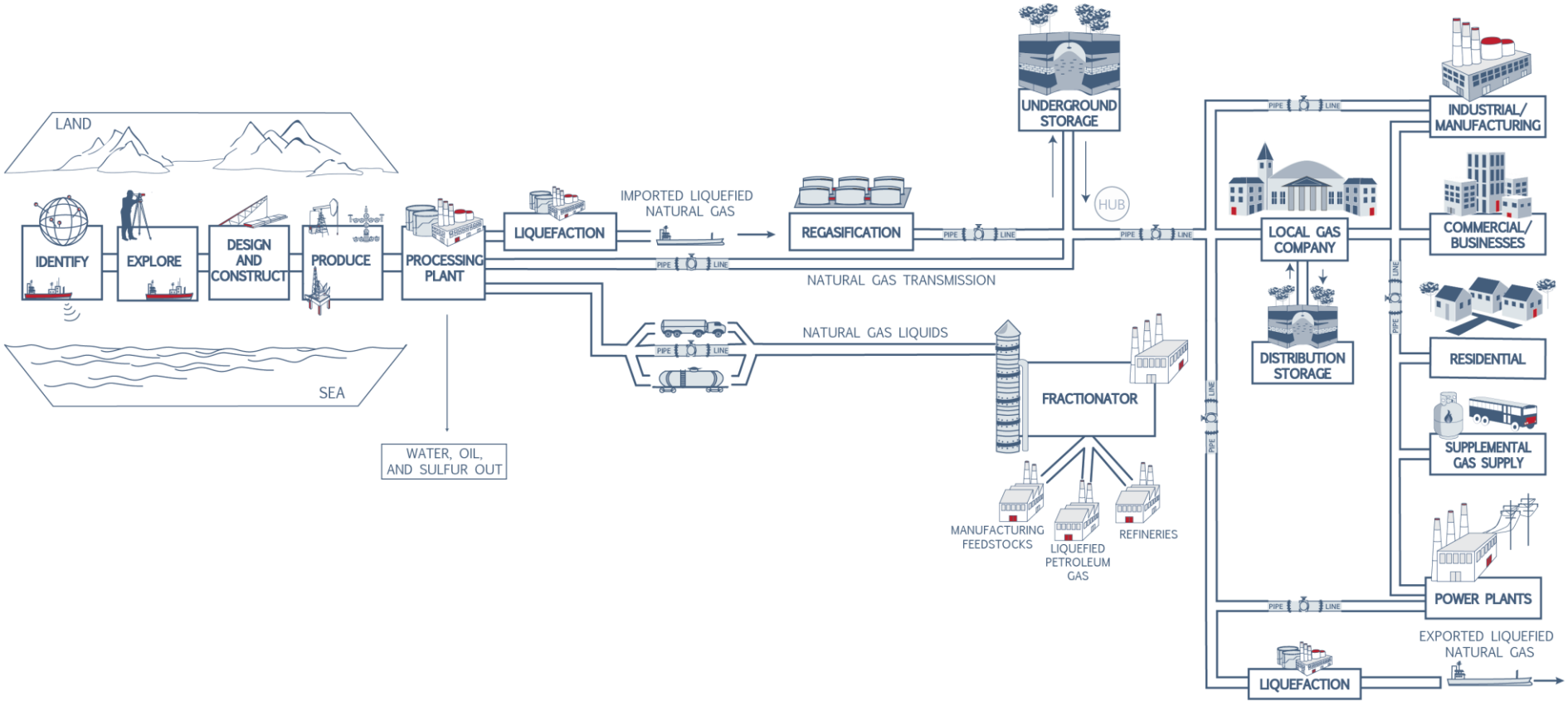
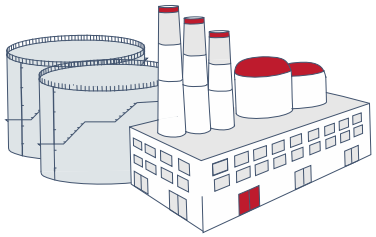
THE NATURAL GAS SUPPLY CHAIN



RESOURCES: PEOPLE (HUMAN BEHAVIOR, SKILLED/TRAINED PERSONNEL) | POWER (ELECTRICITY) | WATER | IT (TELECOM, CYBER, ACCESS CONTROL)

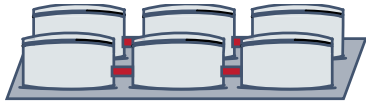
energy API

UNDERSTANDING THE COMPONENTS



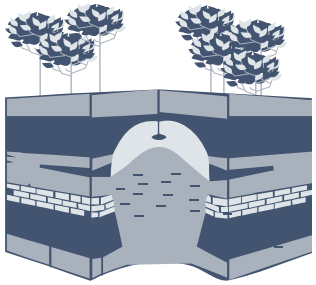
PROCESSING PLANT

PIPELINE

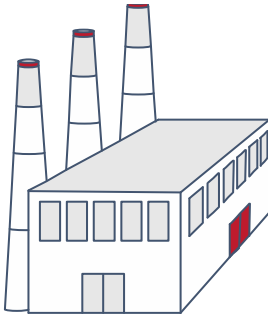


REGASIFICATION

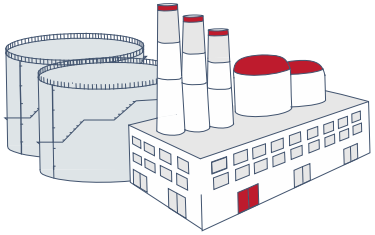
HUB



STORAGE



FRACTIONATOR



LIQUEFACTION

LIQUEFIED NATURAL GAS SHIPPING

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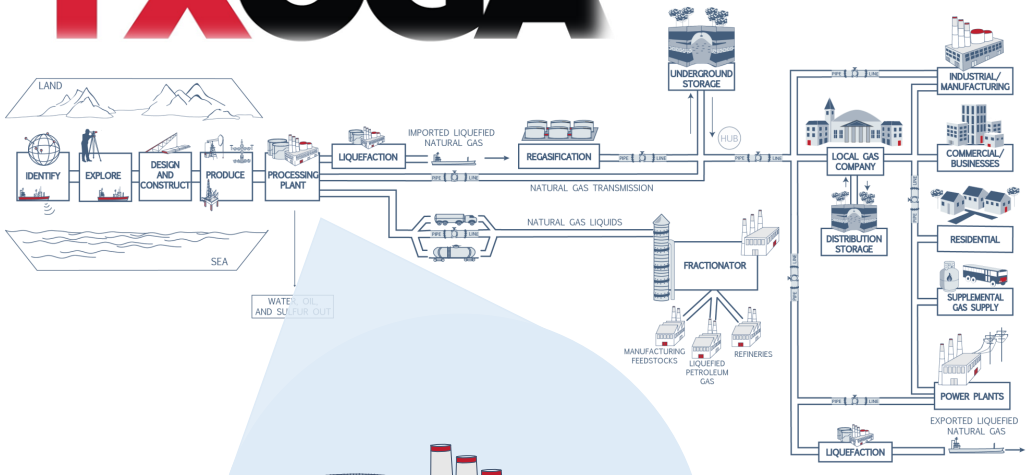

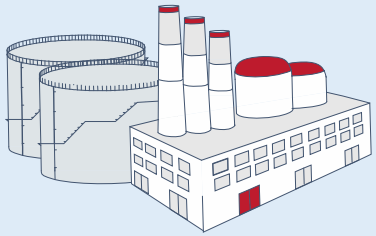

Overview

Processing plants clean raw natural gas by separating impurities and the various hydrocarbons and fluids from pure natural gas, producing what is known as 'pipeline quality' dry natural gas, also known as methane. A fully operational processing plant delivers pipeline quality dry natural gas that can be used as fuel by residential, commercial, and industrial consumers.

PROCESSING PLANT

STATISTICS

- Over 500 natural gas processing plants in the United States
- Over 16,000 billion cubic feet of natural gas processed in 2012
- Almost 800 million barrels of liquid natural gas extracted in 2012
- Natural gas heats 51% of US homes

KEY TAKEAWAY

We now have a 100-year supply of clean-burning natural gas that we didn't know about just a few years ago. The first-ever natural gas jobs study* found that the natural gas industry supported nearly 3 million jobs and added nearly $385 billion to the national economy in 2008.

*Source: http://www.anga.us/media/content/F7BE35D7-E47C-5BB9-DA1CBB373BFBDB3C/files/ihs%20global%20insight%20anga%20u.s.%20economic%20impact%20study.pdf

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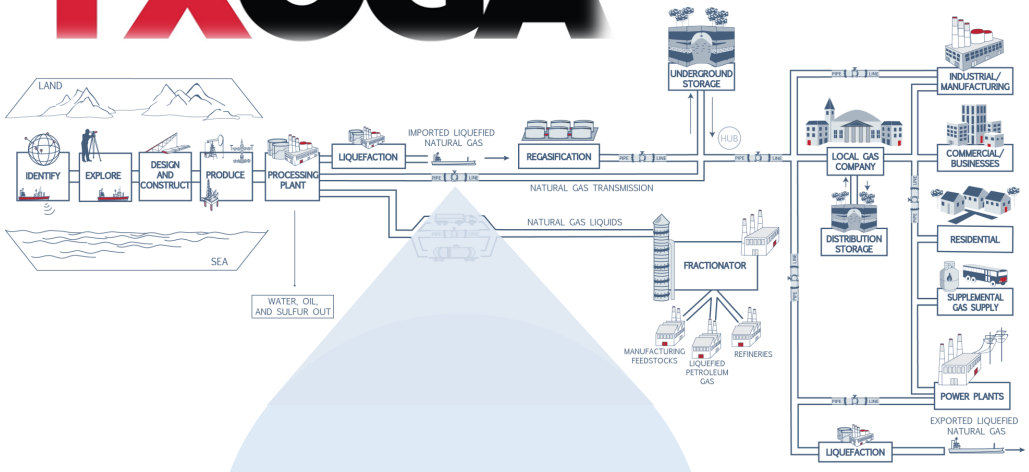
PIPELINE



Overview

The US natural gas pipeline network is a highly integrated transmission and distribution grid that can transport natural gas to and from nearly any location in the contiguous United States. Pipelines can be characterized as interstate or intrastate. Interstate pipelines are long-distance, high-capacity pipelines that transport natural gas throughout the nation. Intrastate pipelines link natural gas producers to local markets as well as the interstate pipeline system.

STATISTICS

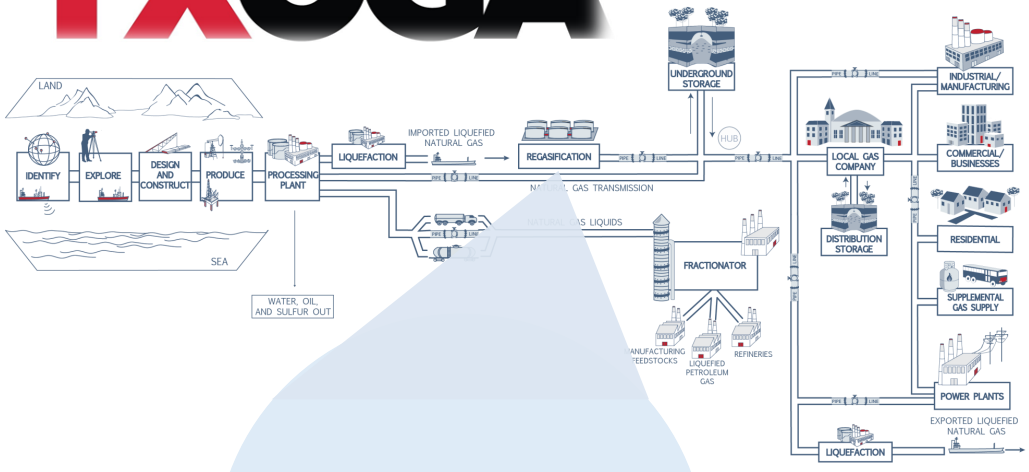
- Over 305,000 miles of natural gas pipeline in the United States
- Over 95% of natural gas used in the United States moves from well to market entirely via pipeline
- Over 11,000 delivery points, 5,000 receipt points, and 1,400 interconnection points that provide for the transfer of natural gas

KEY TAKEAWAY

Natural gas meets 24% of US energy demand.

energy API

REGASIFICATION



Overview

Regasification is the process of transforming liquefied natural gas (LNG) into a gaseous state through vaporization, preparing it for use. This process occurs at regasification plants, where the temperature of LNG is increased, typically through seawater vaporizers, transforming it into gas.

STATISTICS

- There are more than 10 regasification terminals in the United States, with an additional eight proposed sites
- In 2011, the United States imported almost 350 billion cubic feet of LNG

KEY TAKEAWAY

Imports of natural gas have decreased more than 50% since 2007 due to the discovery of the shale gas formations along the Northeast's Appalachian Basin, the deep water of the Gulf of Mexico, and the vast potential of the Arctic and other offshore resources.

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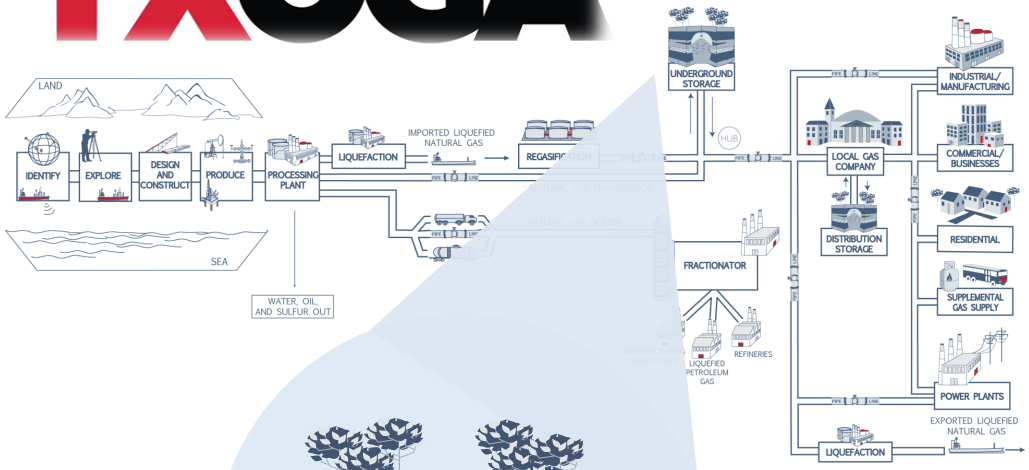
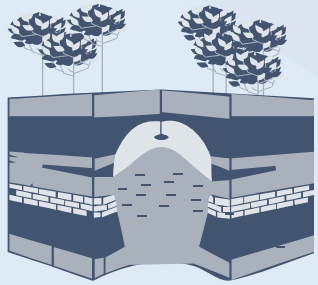
STORAGE





Overview

Natural gas is stored in three principal types of large underground storage systems: depleted natural gas reservoirs, aquifers, and salt caverns. More than 80% of natural gas storage capability consists of depleted reservoirs, which are relatively easy to convert to storage facilities after use and are typically located near consumption centers and existing pipeline systems. Natural gas can also be stored as liquefied natural gas (LNG), which reduces its volume to 1/600th of the volume of natural gas, making it more efficient and practical to store and transport.

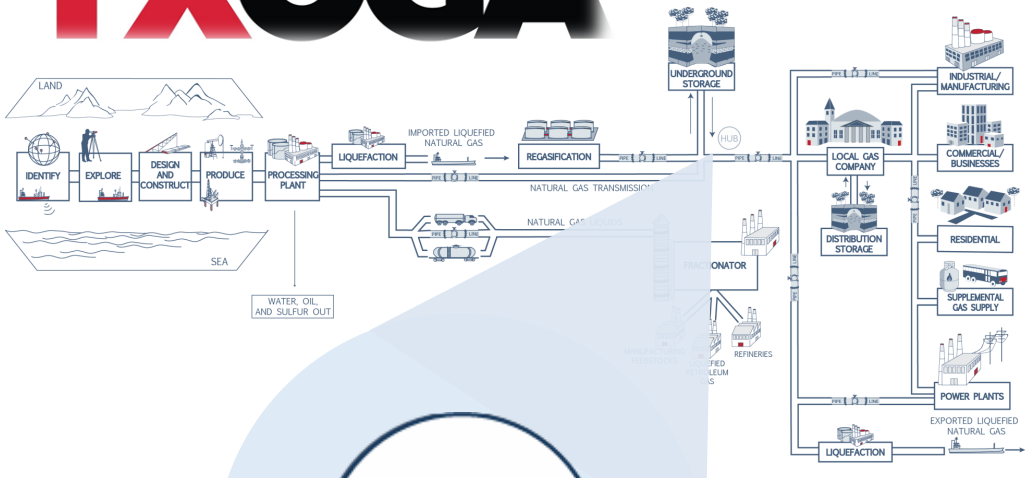
STATISTICS

- Over 400 storage facilities in the United States
- Total storage capacity of over 9,000 billion cubic feet

KEY TAKEAWAY

Today, many storage facilities operate on an open access basis, especially those sites affiliated with natural gas market centers. Open access allows storage to be used other than as backup inventory or a supplemental seasonal supply source. For example, marketers may move gas into and out of storage as changes in price levels present arbitrage opportunities.

HUB



HUB

Overview

Natural gas hubs are locations where natural gas is priced and traded throughout the country. These 'market hubs' are located at the intersection of major pipeline systems. The principal hub within the United States is the Henry Hub in Louisiana.

STATISTICS

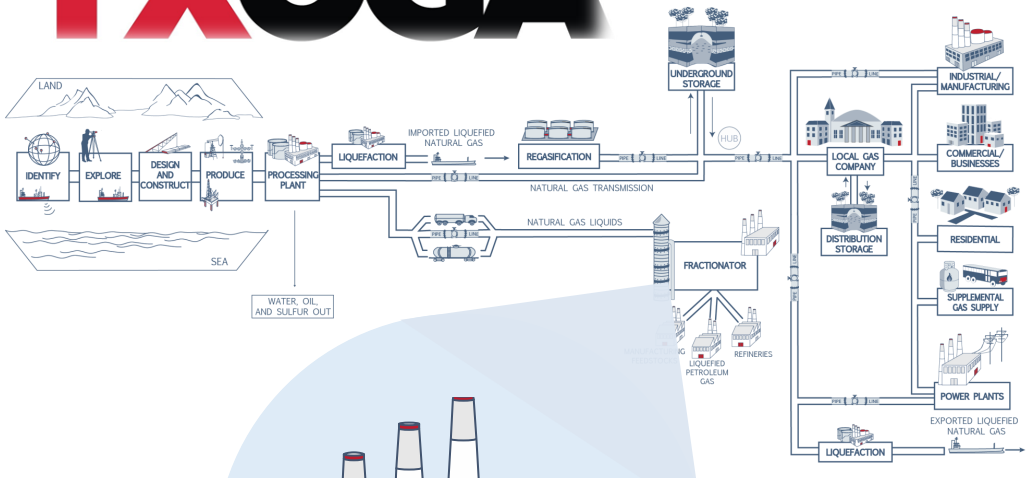
- Over 30 major market hubs in the United States
- Almost 25,000 billion cubic feet of marketed production in 2011

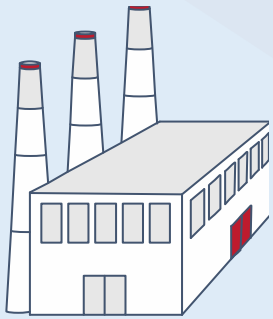
KEY TAKEAWAY

Average natural gas spot prices at most major trading points increased 40-60% during the first half of 2013, compared to the same period in 2012, as demand for natural gas outpaced increases in supply.*

*Source:
http://www.eia.gov/todayinenergy/detail.cfm?id=12191

FRACTIONATOR





Overview

The fractionation process is the breaking down of natural gas liquids (NGLs) into their base components in order to be useful, and occurs at a fractionator facility. Common base components of NGLs include ethane, propane, pentane and butane. Fractionation occurs in stages, separating each base component from the stream of mixed NGLs, one-by-one.

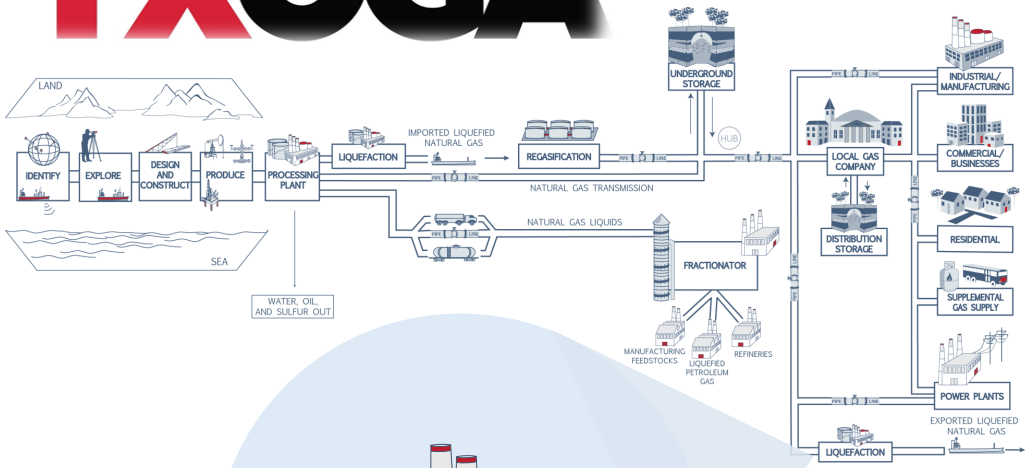
STATISTICS

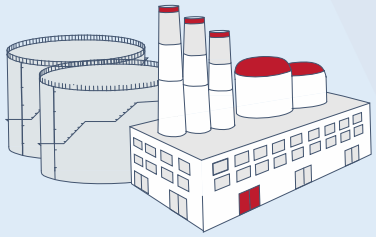
- Of the more than 16,500 billion cubic feet of natural gas processed in 2011, almost 800 million barrels of liquids were extracted
- US natural gas plant liquids proved reserves rose from 8,557 million barrels in 2009 to 9,809 million barrels in 2010 – an increase of 15%

KEY TAKEAWAY

The sustained lower price environment for natural gas relative to oil has encouraged operators to shift drilling and development programs toward "liquids-rich" areas within shale gas plays that offer a higher yield of NGLs and crude oil.

LIQUEFACTION





Overview

Liquefaction is the physical conversion of a gas into a liquid state. Liquefaction occurs at normal atmospheric pressure by super-cooling the natural gas to -260°F, creating liquefied natural gas (LNG). Prior to liquefaction, certain unwanted components, such as dust, acid gases, helium, water, and heavy hydrocarbons, are removed as they can cause difficulty downstream.

STATISTICS

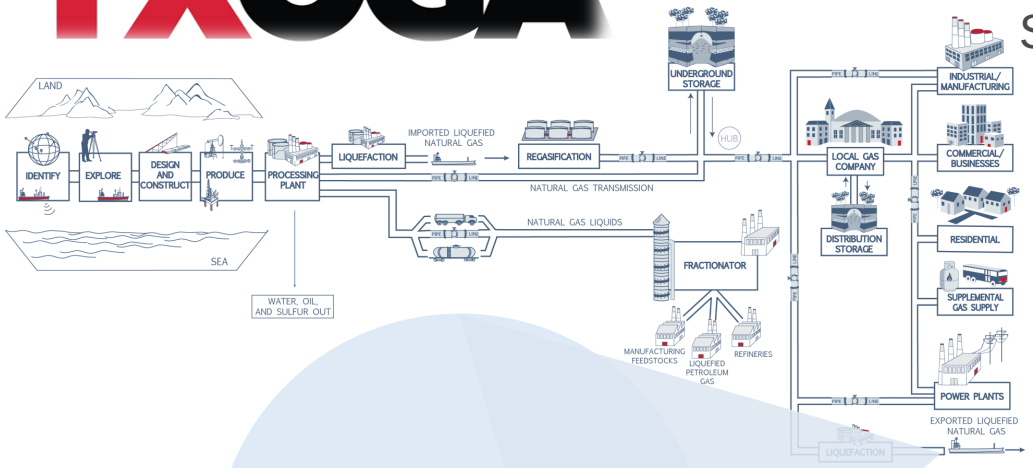
- There is one liquefaction terminal in the United States, with an additional eight proposed sites
- 110 LNG facilities operate in the United States
- In 2012, the United States exported over 1,600 billion cubic feet of LNG

KEY TAKEAWAY

LNG exports will drive additional US natural gas production, which will support the creation of thousands of additional jobs. An IHS Global Insight report* on the economic impacts of shale gas estimates that for every 1 billion cubic feet per day of shale gas production, approximately 32,000 jobs are supported throughout the economy.

*Source: http://www.ihs.com/info/ecc/a/shale-gas-jobs-report.aspx

SHIPPING LIQUEFIED NATURAL GAS



Overview

Liquefied natural gas (LNG) shipping provides a low-cost, safe, and environmentally responsible method to move large volumes of product long distances. LNG is transported in specially-built tanks on double-hulled ships. LNG carriers are among the safest in the shipping industry, having made more than 100,000 voyages without major incident.

STATISTICS

- In liquid state, the volume of natural gas shrinks by approximately 600 times, creating easier storage and transport for marine shipments
- As of 2011, there were over 350 ships engaged in the deep sea movement of LNG

KEY TAKEAWAY

Marine shipping is the most economical mode of commercial freight transportation, due to the enormous capacity of tankers and barges. The industry allows the United States to take advantage of its 25,000-mile waterway system and adds $5 billion a year to the US economy.

Thank you to EnergyAPI for the use of their graphics and presentation information.

For more information on the visual depiction of this supply chain model, please contact:

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