Basic Products Course

Module 1: Industry Overview
The History and an Overview of the Oil Industry

This lesson will cover how the petroleum industry started, some of its accomplishments, and where it is today.
We will cover the petroleum industry in FOUR steps:

- History of petroleum usage
- Discoveries in the petroleum industry
- Developments in drilling
- The industry today
Module 1:
Industry Overview

Part 1:
History of the Petroleum Industry
This history of petroleum goes back to the beginning of recorded time.

What does petroleum mean?

- Petroleum comes from two Greek words
- *petra* means rock.
- *oleum* means oil.
- Petroleum means ROCK OIL.
History

Now that we know what petroleum means, let's look at some of the early users.

- **Sumerians, Assyrians, Babylonians, Persians (3000 B.C.):**
  - used asphalt for:
    - building roads
    - waterproofing boats

- **Egyptians (2000 B.C.):**
  - used both pitch and asphalt for:
    - caulking boats
    - lubricating chariot axles
    - preparing mummies
History

Chinese (1200 B.C.):
- used natural gas and oil for:
  - fuel... Natural gas was used to light the emperor's palace.
  - They even built a bamboo pipeline to move the gas.

Peoples of the Middle East (1200 A.D.):
- used pitch for:
  - illumination
  - While Europe was in the Dark Ages, Middle Easterners learned to distill petroleum.

Early uses of petroleum were limited but important. This limited use would continue until the 19th century.
So, how did these early users of Petroleum find it?

There were two basic places that rock oil was found in those days.

- **Surface Seepages**
  - Occurred when petroleum bubbled up through the ground.
  - Often pooled in low lying areas

- **Subsurface Reservoirs**
  - Were discovered when wells were drilled for brine or water.
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Part 2: Discoveries in the Petroleum Industry
The petroleum industry that we depend upon today is largely a result of discoveries and inventions of the nineteenth century.

Before we look at these discoveries, let's see which non-petroleum products were used in the early 1800s.
**Illumination:**

- With the growth of cities came the increasing need for illumination. Up to the early 1800s, whale oil was used in lanterns for illumination. Fuel for the illumination became increasingly important during the early 1800s.

**QUICK QUESTION:**

What was the primary fuel for illumination in the early 1800's?

- **Whale oil**
- **Kerosene**
- **Pitch**
- **Natural gas**
Lubrication:

- Animal fat, mainly from whales, was used as a lubricant.
- Whale oil was used to lubricate axles and parts on steamboats.
- During the early 1800s, a limited number of lubricants were available.

QUICK QUESTION:

Which products were used to lubricate wagons and steamboats in the early 1800s?

- Fuel oil
- Kerosene
- Animal fat, mainly from whales
- Gasoline
By the mid to late 1800s there was a critical shortage of whale oil... Why?

- There was a dramatic increase in the demand for whale oil.
- Whales had nearly disappeared in the Atlantic because of over hunting.
- Hunting began in the Pacific. However, the cost of transporting the whale oil from the west to east coast was prohibitive.

Despite these issues, major products were derived from the whale oil until late 1800s.

**QUICK QUESTION:**

Why did the price of whale oil increase substantially by the late 1800s?

- **Increased demand**
- **Scarcity of whales in the Atlantic**
- **Whale oil had to be transported from west to east coast**
- **All of the above**
Discoveries

Clearly a more plentiful fuel was needed. The westward expansion helped to find the new fuel...

Westward Expansion:

- Early pioneers, drilled wells for salt and water, frequently found wells contaminated with oil. Normally the oil was either drained off or burned. However, some individuals were determined to find a use of for the black oil. One such person was Samuel Kier.

- Samuel Kier’s first oil enterprise was selling "Kier's Rock Oil" for its alleged healing properties. The rock oil did not sell well, so Kier used a crude still to convert the oil into lamp fuel. It worked, but the fuel product a heavy black smoke and a bad odor as it burned.

- Because of the problems with this fuel, Kier’s attempts to market it were unsuccessful. But, Kier had begun the work that led to the distillation of clean fuels such as kerosene.
Westward Expansion (cont):

The distillation of the oil to kerosene was successfully done in 1852. This caused a revolution in illumination. Kerosene lamps quickly replaced whale oil lanterns. Kerosene was not only a cleaner-burning fuel, but it was also less expensive and more plentiful.

By the end of the 1850s, over 50 companies in the U.S. were producing kerosene to meet the increasing demand. This clean burning fuel proved to be an excellent substitute for whale oil.

QUICK QUESTION:
In 1852, oil was distilled into which fuel?

- Gasoline
- Kerosene
- Animal fat
- Pitch
The inventions of the late 1800s had a revolutionary effect on the society. All were powered by petroleum products.

- **Edison's incandescent light (1878):**
  The incandescent light led to oil fired generating plants, which created the electric power industry.

- **Benz and Daimler's improved internal combustion engine (1886):**
  Improved internal combustion engines could be used in cars. The automobile industry was born.

- **Diesel's engine (1897):**
  Diesel's engine used oil for fuel. The diesel engine was named after German engineer Rudolf Diesel.
The inventions had an immediate effect on society.

- After 1900, kerosene lamps were replaced by gas and electric lights in most metropolitan areas.
- From 1900 - 1910, automobile production rose from 8000 cars per year to 450,000.

**QUICK QUESTION:**
Which invention(s) of the late 1800s generated the need for large quantities of petroleum?

- Diesel engine
- Incandescent light
- Improved internal combustion engine
- All of the above
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Part 3: Developments in Drilling
The wells in the 1800s and early 1900s played a significant role in the history of drilling. These were:

**Ruffner Well (1807 and 1808):**

David and Joseph Ruffner drilled for brine in Charleston. The tools and techniques they used greatly advanced current drilling methods. These tools were:
- A bit with 2 1/2" steel chisel
- A drilling line
- A wood casing
Drake Well (1858 and 1859):
- The Drake Well was the first well drilled exclusively for oil. Drake proved that oil could be found by:
  - Searching out oil seeps on the surface
  - Matching geologic formations with known oil sites
- On August 27, 1859, Drake hit oil, marking a milestone in oil exploration
Lucas / Spindletop Well (1900 and 1901):

- Used a hydraulic rotary drilling rig.
  - This allowed drilling in harder formations.
- This rig produced the first gusher and expanded the search for oil.
- Largely credited with creating the U.S. oil industry that we know today.
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Part 4: The Industry Today
Today, petroleum companies can be separated into integrated and non-integrated.

- **Non-Integrated Companies**
  - Participate in only some of the phases

- **Integrated Companies**
  - Involved in all phases of the industry
    1. Locating
    2. Drilling
    3. Refining
    4. Marketing
    5. Transporting

Prior to May of 2012, we were part of a large Integrated Company that had grown from several smaller companies. In May of 2012, Phillips 66 became an independent, Non-Integrated Petroleum Company specializing in the 3 latter phases of Integrated Companies.
Industry Today

Integrated Companies

Phases of the industry

1. **Locating** - As we discussed earlier, petroleum is found in subsurface reservoirs. In the past these reservoirs were found almost entirely by chance. Today, two different methods are employed for finding reservoirs:
   - **Geophysical Method:** Geophysics is the study of the earth. The geophysical method applies these principles to locate subsurface petroleum reservoirs. This includes conducting magnetic, gravity, and seismic surveys.
   - **Stratigraphic Method:** The stratigraphic method uses various records such as driller's logs, sample logs, electric logs, and other collected data. All this data is compiled to develop subsurface contour maps of different regions.
Phases of the industry

2. **Drilling** - Two different methods are used for drilling oil:
   - In-field: The rigs and the platform are built on land.
   - Off-shore: The rigs and the platform are anchored in water.
3. **Refining** - Raw crude oil contains various parts of:
   - Asphalt
   - Paraffin (Wax)
   - Impurities
   - Natural Gas

The first step in refining is to separate these elements. This is done by distilling crude oil. Let's take a very simplified look at this process.
3. Refining cont.

- Distillation
  - The distillation process heats the crude oil under controlled conditions. This causes the lightest components to rise or even evaporate and the heavier components to separate and drop to the bottom. We can then pull off our separated “cuts” of distilled products.

The “Heavy Gas Oil” cut is the range that the vast majority of lubricants come from.
3. Refining cont.

Refining processes also involve Feedstocks and Petrochemicals. Feedstocks are anything fed into the refining process. A few examples of feedstocks are:

- Crude oil
- First run stocks
- Residual products

Petrochemicals are chemicals made from petroleum. A few of the thousands of products produced through refining petrochemicals include:

- Plastics
- Paint
- Graphite
- Explosives
- Dacron
- Rayon
- Drugs
- Antifreeze
Integrated Companies

Phases of the industry

4. Marketing & 5. Transportation

- Oil moves from:
  - Oil Fields ===> Refinery ===> Marketplace

- The major transportation routes of oil are from a major producing area.
  - Middle East ===> United States and Europe

- The marketing and distribution network consists of two types of transportation:
  - Overseas by tanker
  - Overland by pipeline, rail tanker car and tanker truck
Industry Today

The major oil producing areas of the world are:

- North America
- Europe / Eurasia
- South & Central America
- Middle East
- Africa

The North American region consumes about 25% of the world’s crude oil, but only produces about 18% with about 13% of the total reserves.

For comparison, the Middle East region consumes about 9%, produces about 33% and has roughly 48% of the total reserves.
The United States of America

- Uses around 20 million barrels of refined petroleum products per day.
- As stated in the previous slide, this is about 1/4th of total world consumption.
- Top producing states include:
  - Texas
  - Alaska
  - California
  - North Dakota
  - Oklahoma
The petroleum industry has an enormous impact on the nation's economy.

- Ninety percent of U.S. population are customers.
- One percent of U.S. population are stockholders.
- Over 1½ million producing wells have been successfully drilled in the U.S.
- Production has risen from 7300 barrels a year to over three billion barrels a year.
- Many U.S.-based companies produce gasoline, oil, lubricants and petrochemicals.

**QUICK QUESTION:**
*From a low of 7300 barrels a year, how high has production risen?*

- One Million barrels a year
- Five million barrels a year
- One Billion barrels a year
- Three billion barrels a year
THAT COMPLETES THIS MODULE

Take a BREAK and then go to Module 2, Chemistry.

Keep in mind that Module 1 is the only Module without a review and test. Don't think every module will be this short!