

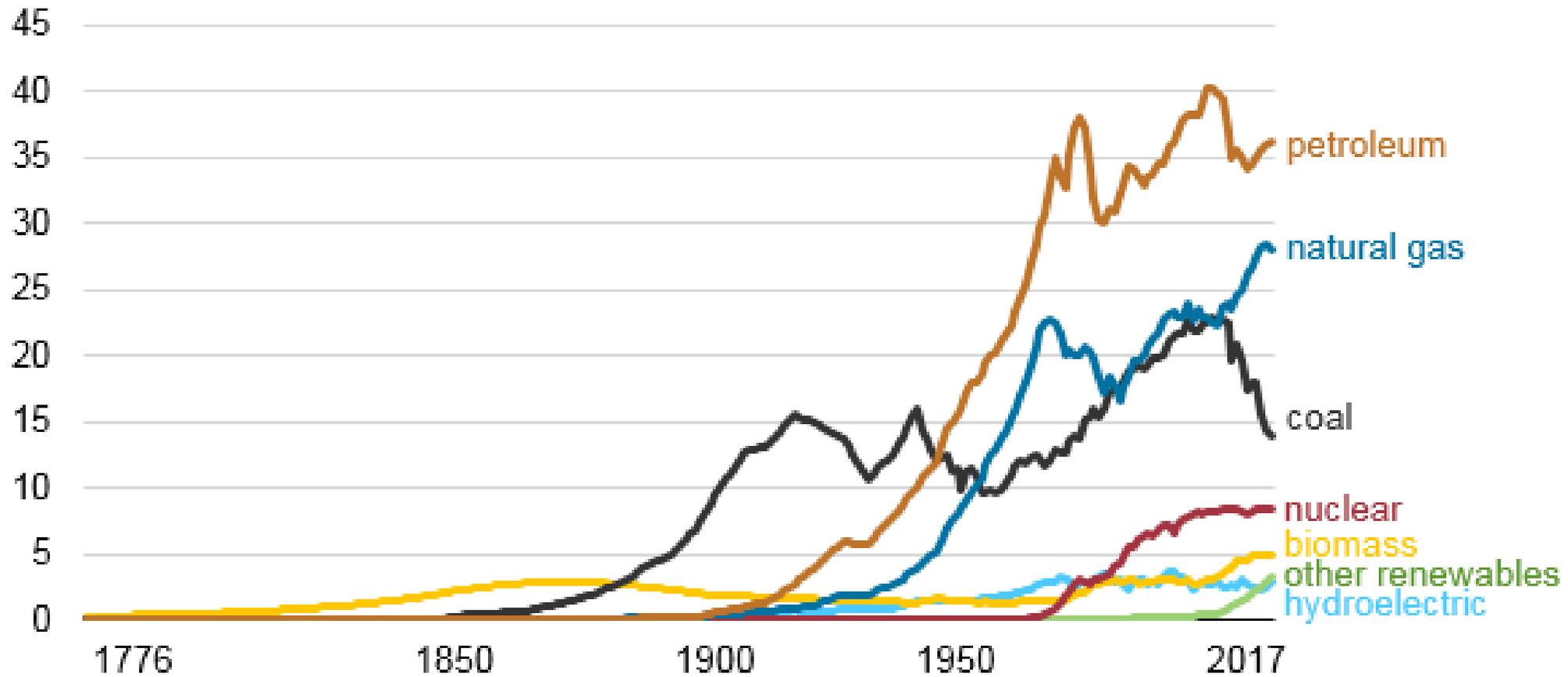


Exploring Oil & Natural Gas



Historical Energy Use by Type of Fuel

Energy consumption in the United States (1776-2017)
quadrillion British thermal units

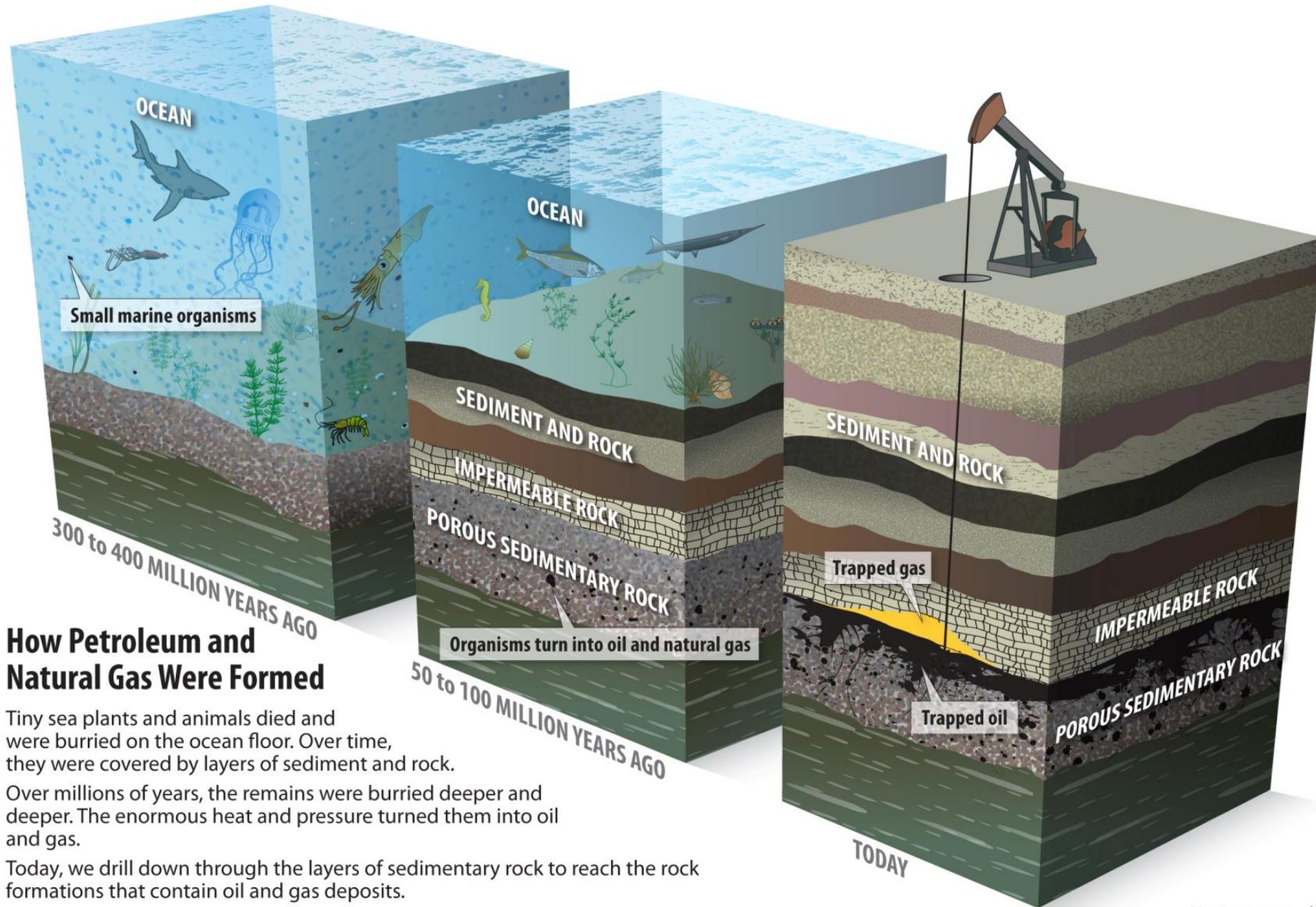


Where are the fossils in Fossil Fuels?



*Fossil fuels were forming
before dinosaurs lived...*

Formation



How Petroleum and Natural Gas Were Formed

Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of sediment and rock.

Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.

Today, we drill down through the layers of sedimentary rock to reach the rock formations that contain oil and gas deposits.

Note: not to scale

H Hydrocarbons C



Plastic



Motor Oil

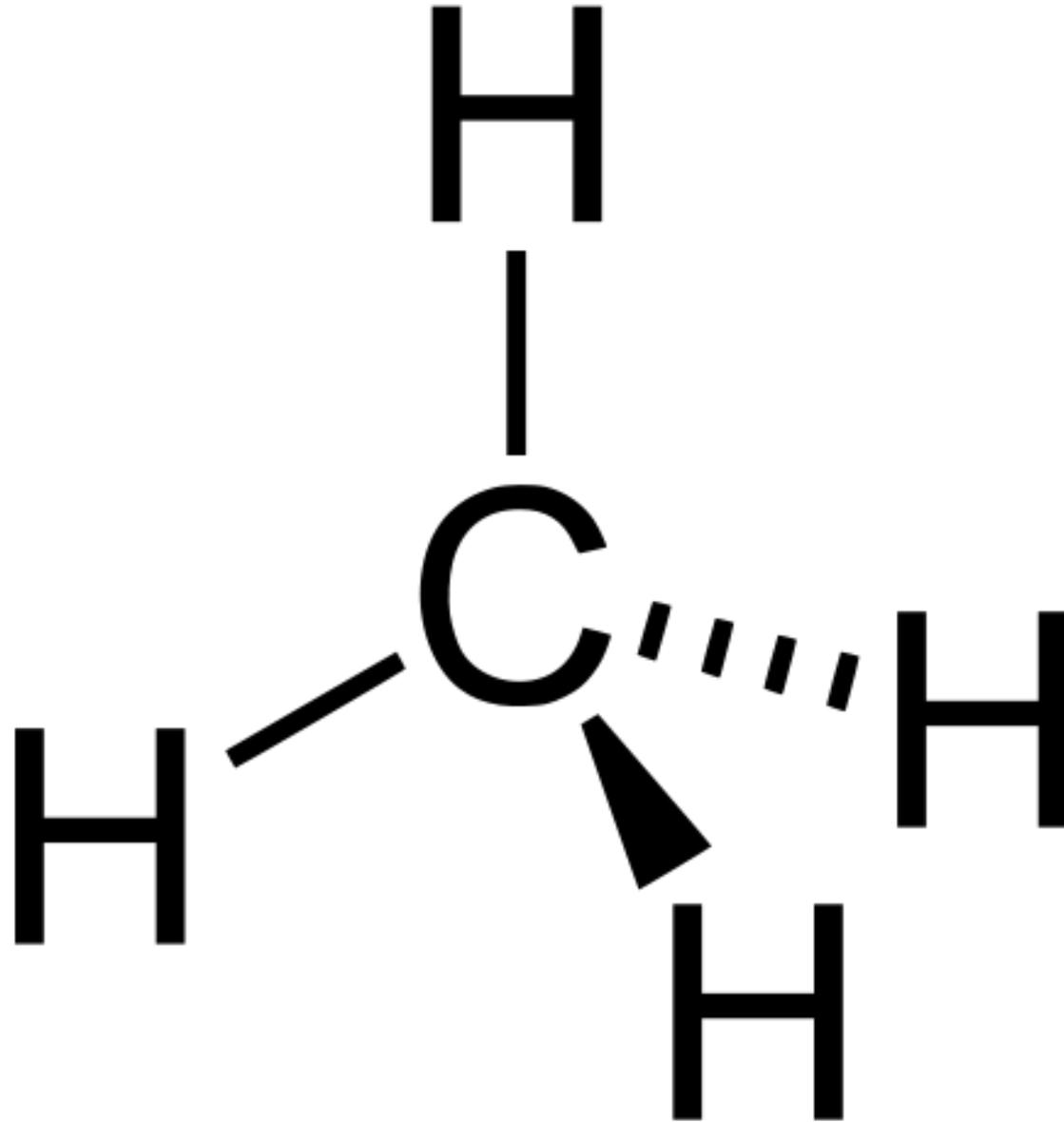


Diesel

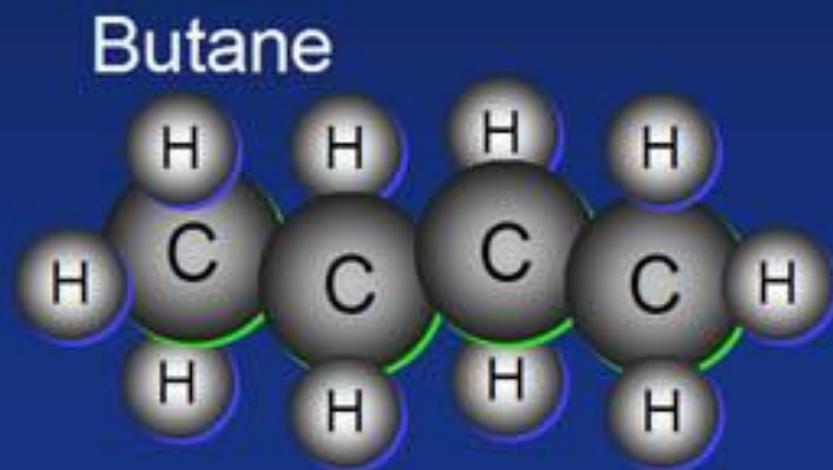
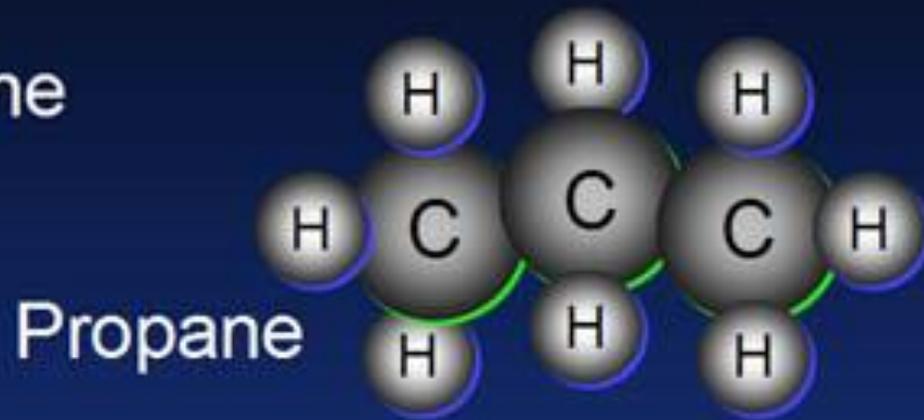
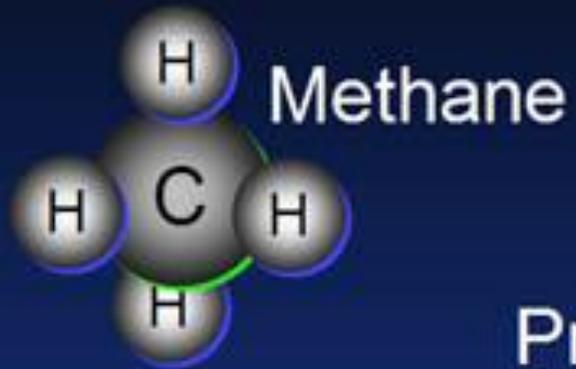


Gasoline

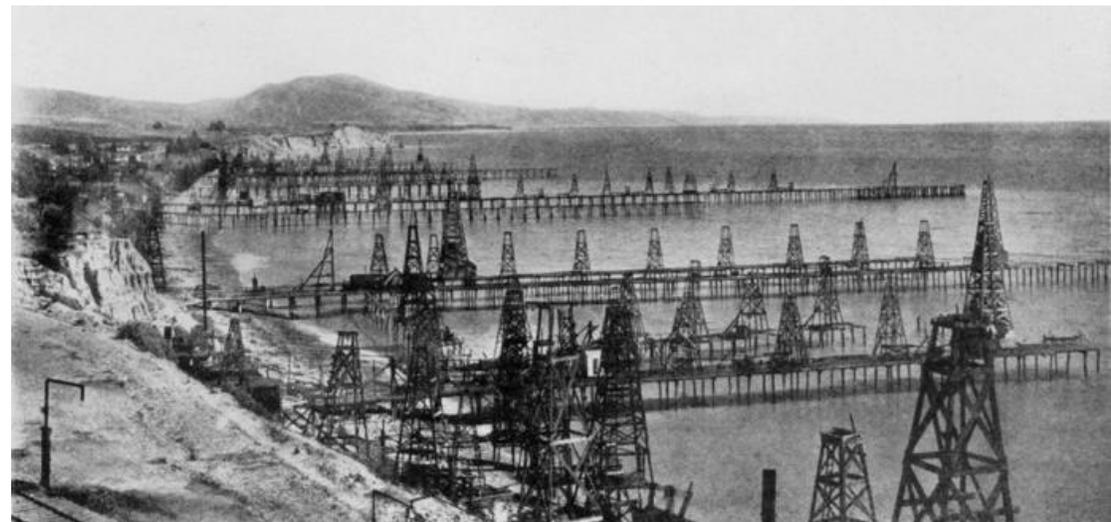
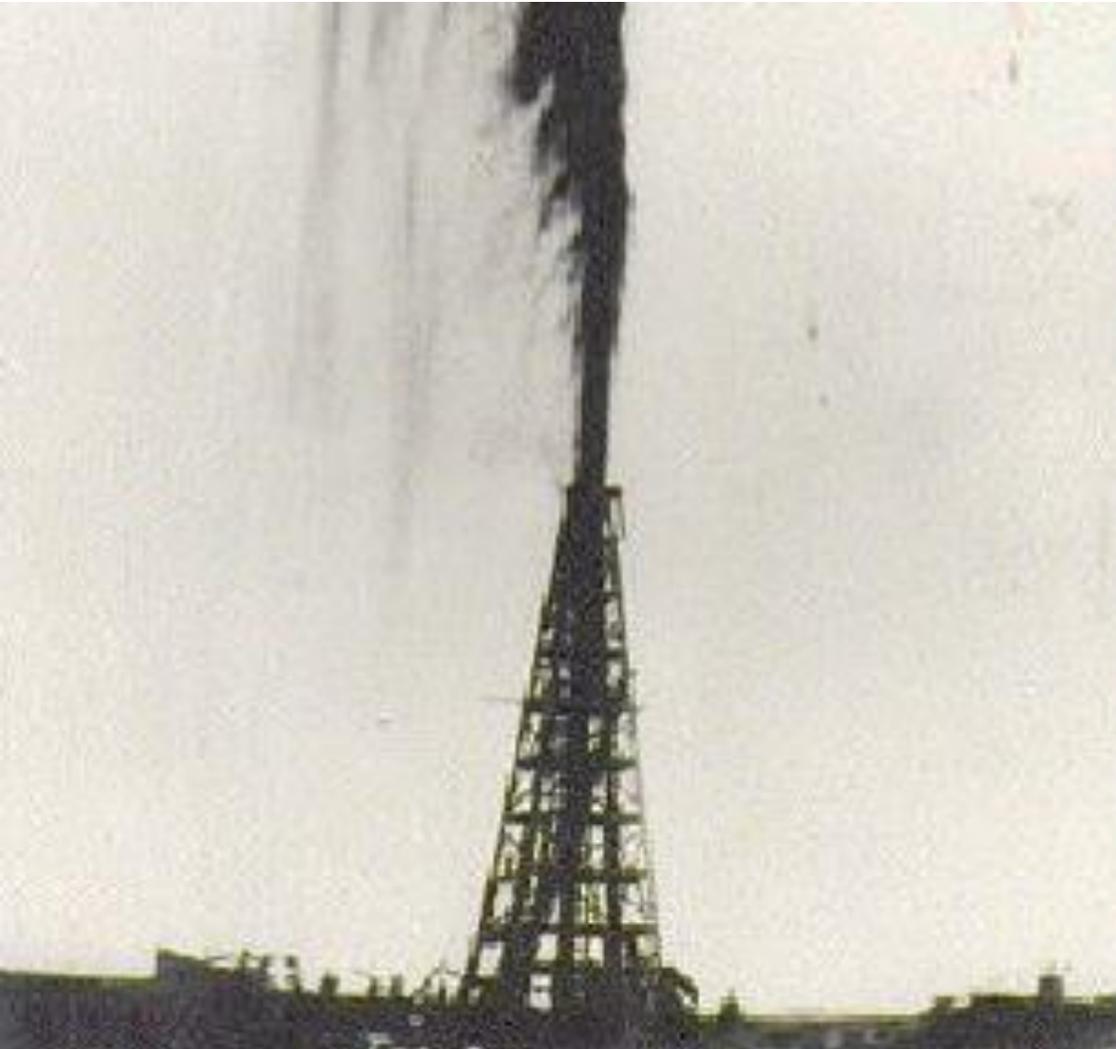
Methane



(H) Hydrocarbons (C)



History of Oil



Edwin Drake and Henry Ford

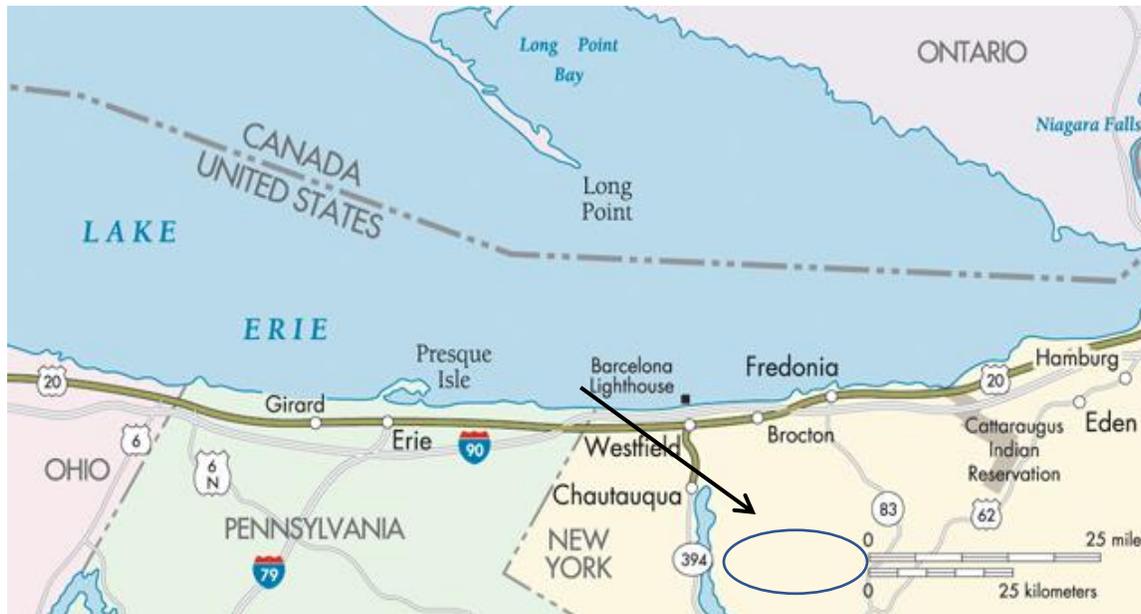


History of Natural Gas

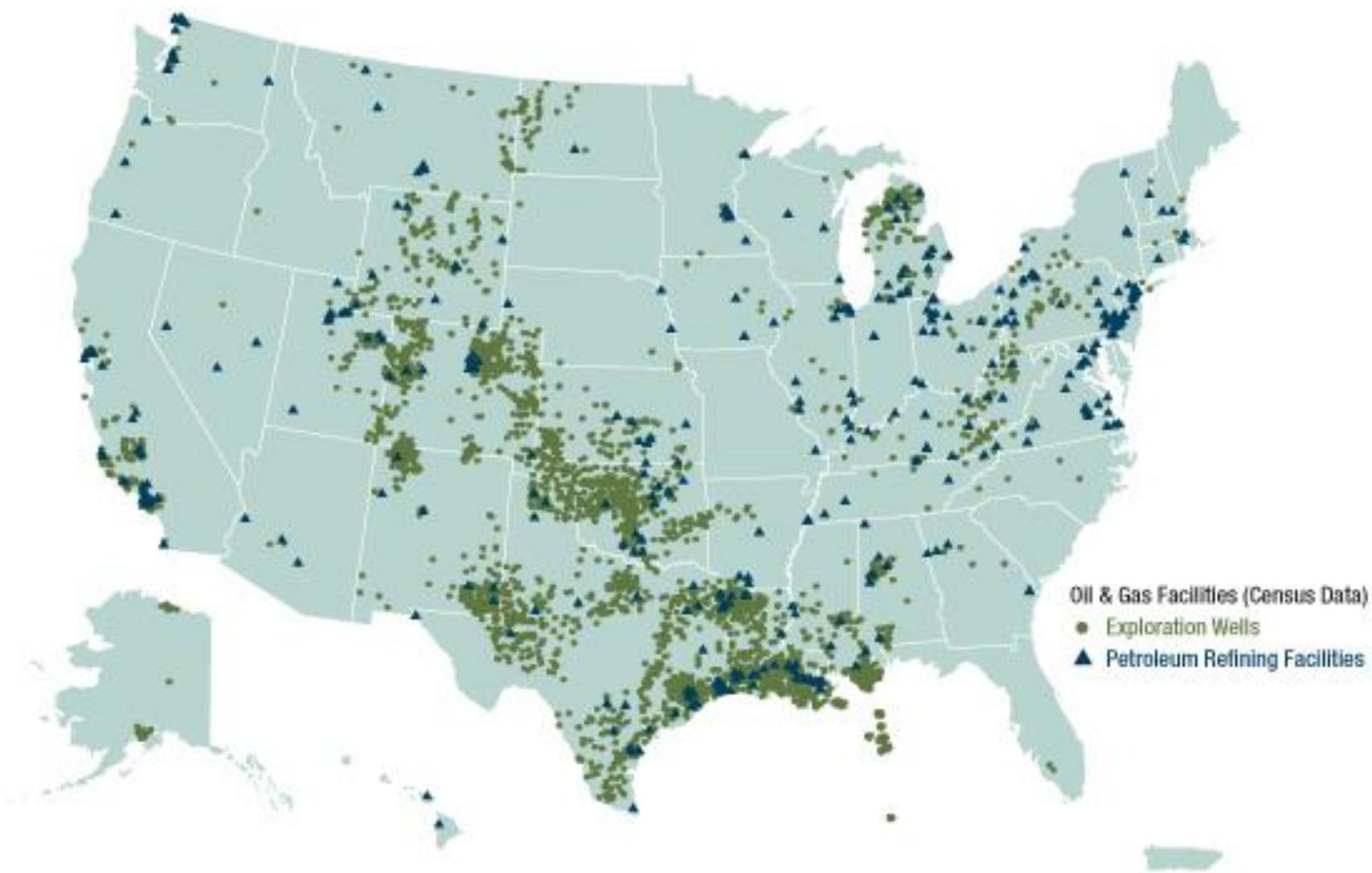


First U.S. Natural Gas Well

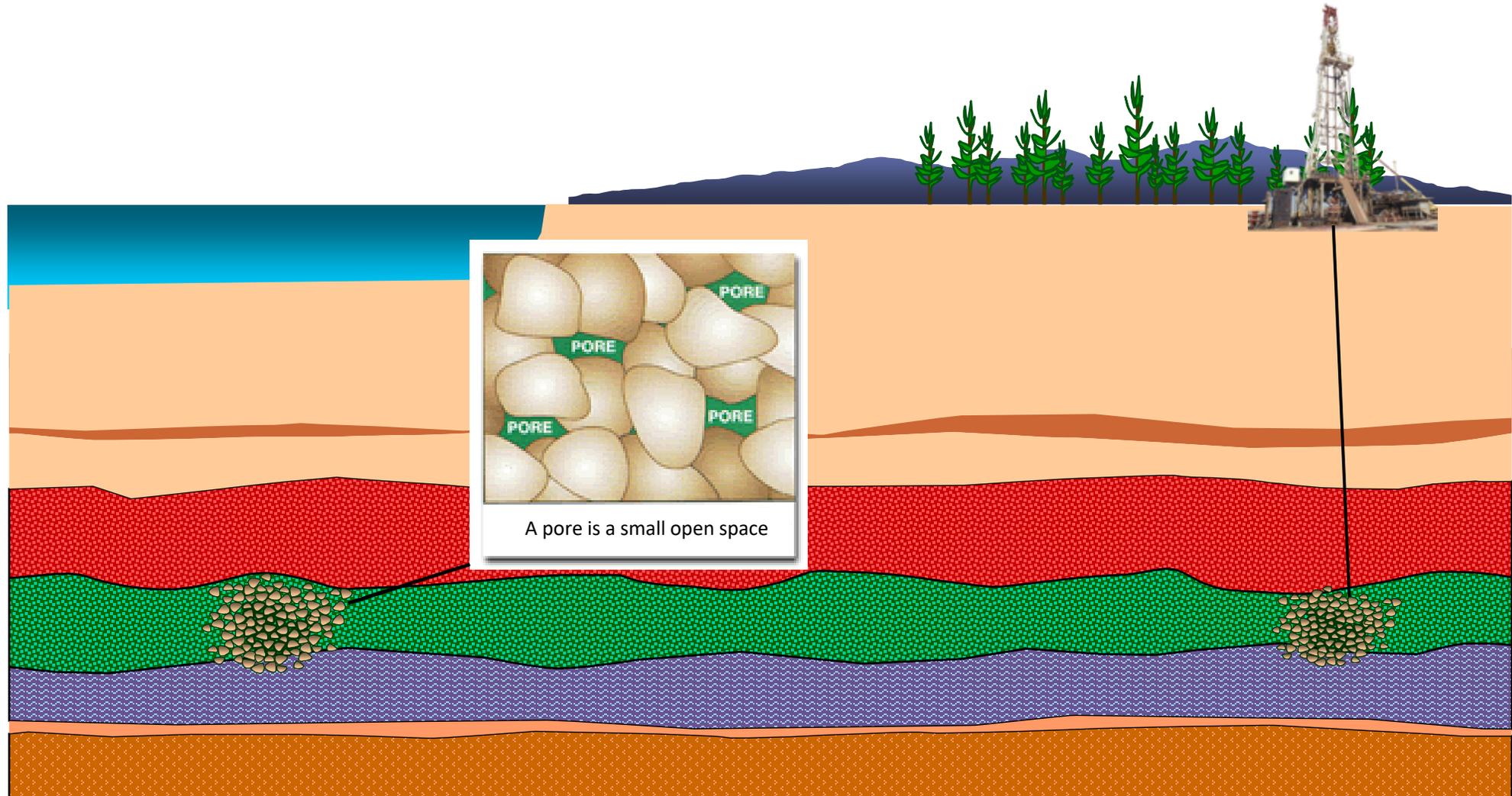
- In 1821, William Hart dug the first natural gas well in Fredonia, NY.



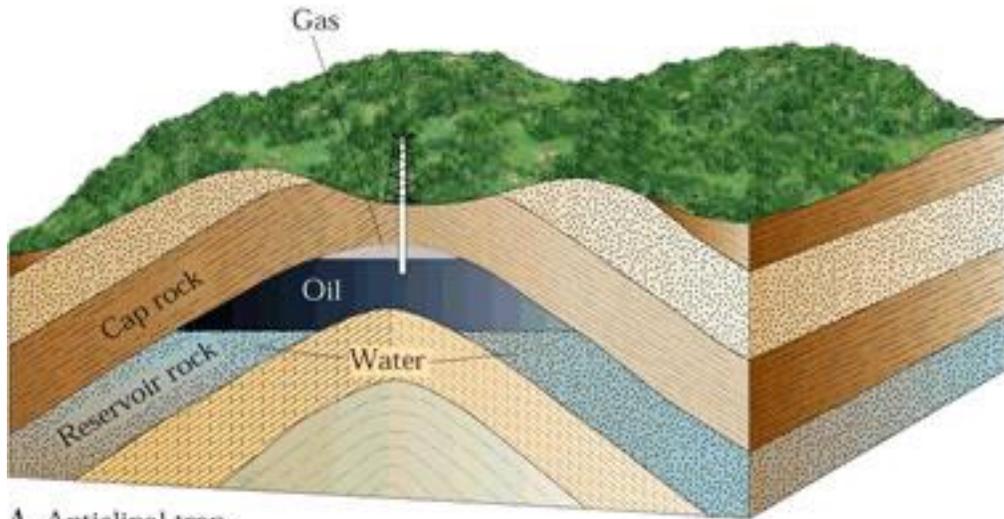
Where are Oil and Gas found in the U.S.?



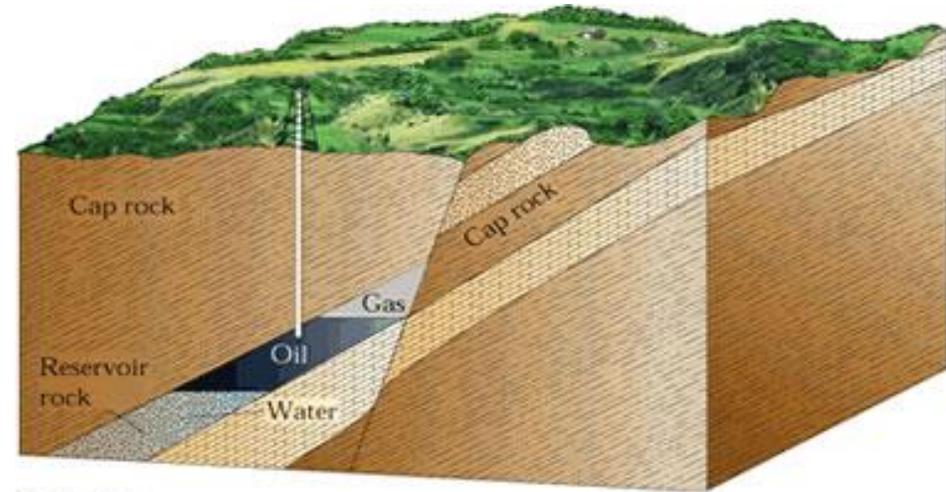
Oil and Gas are found on land and under water...



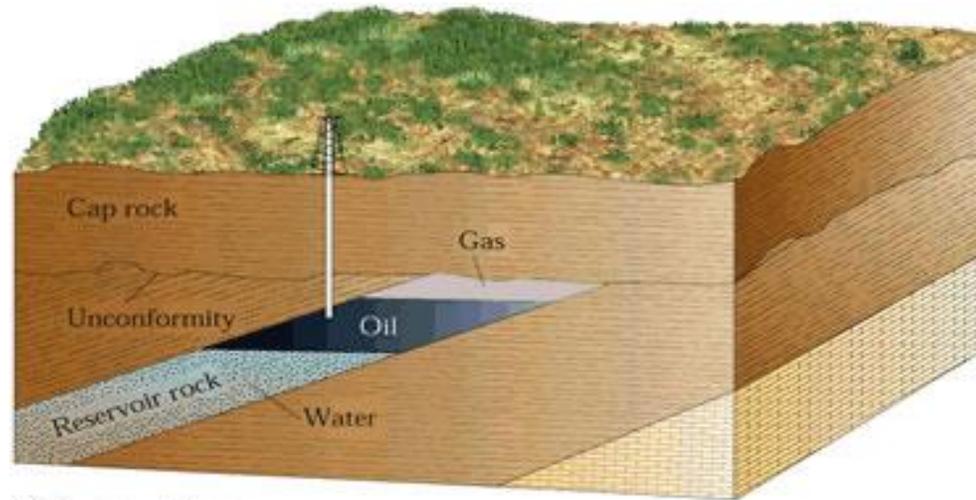
Sedimentary Rock and Petroleum Traps



A. Anticlinal trap

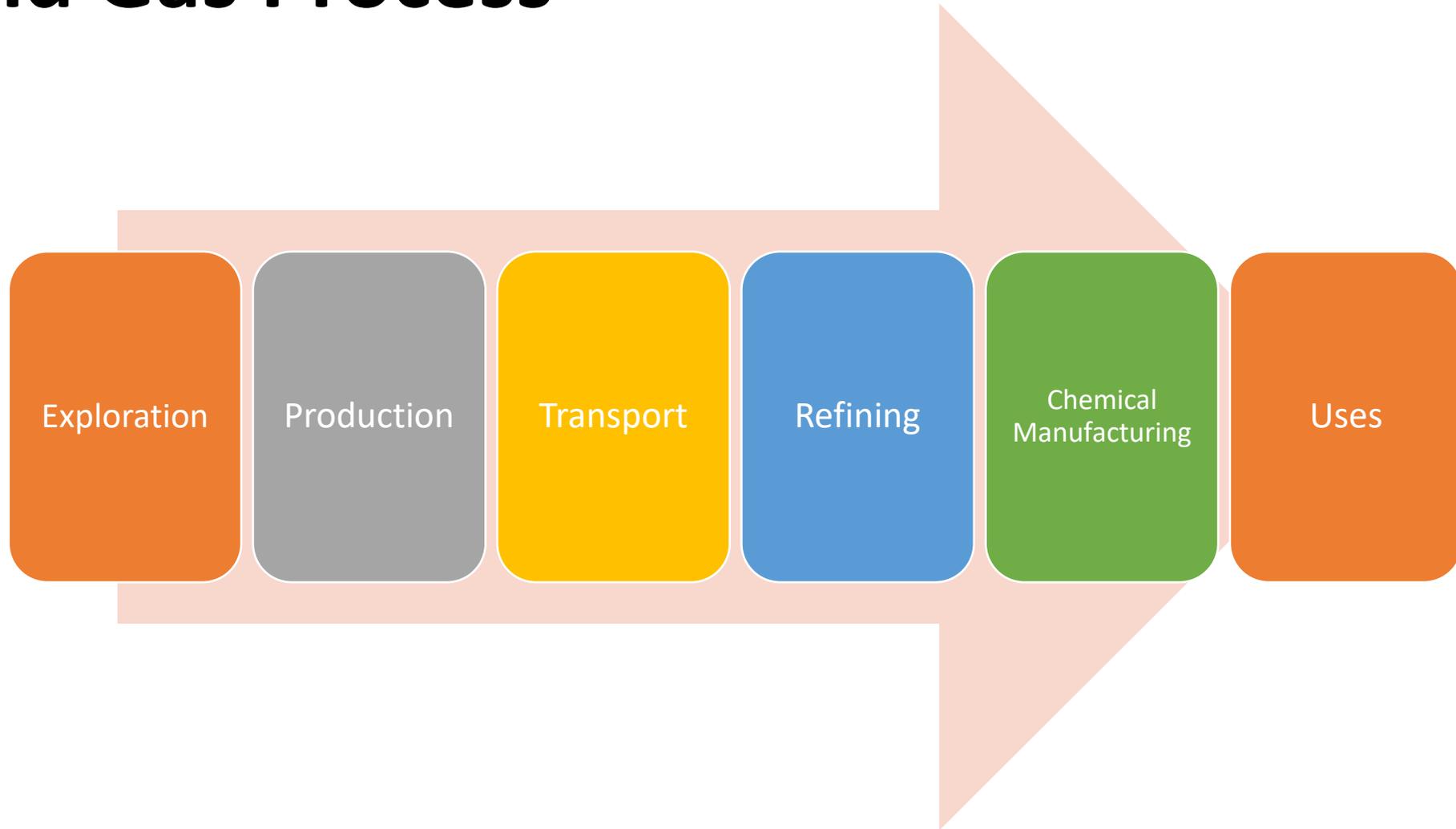


B. Fault trap

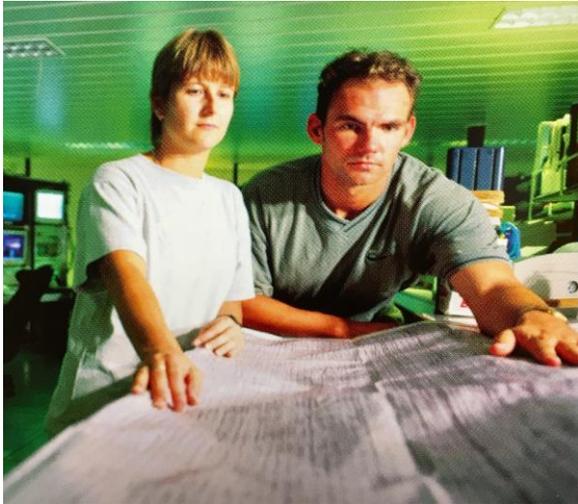
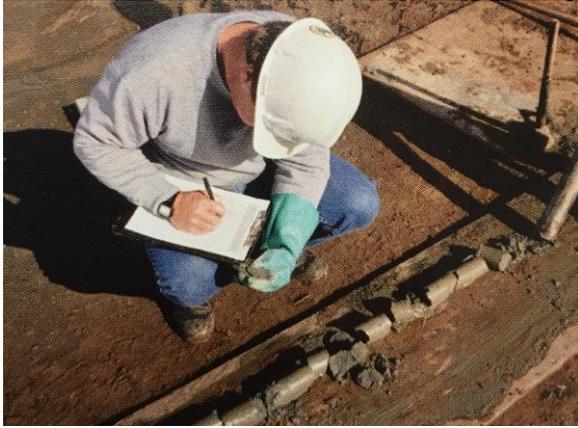


C. Stratigraphic trap

Oil and Gas Process

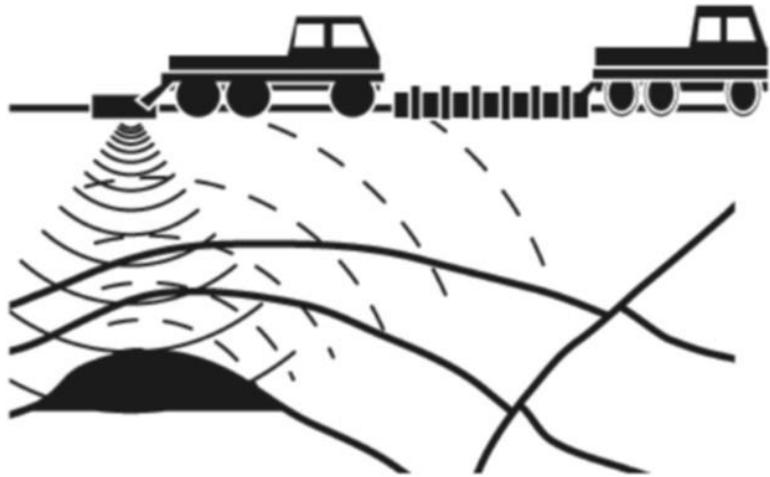


Exploration by Geologists

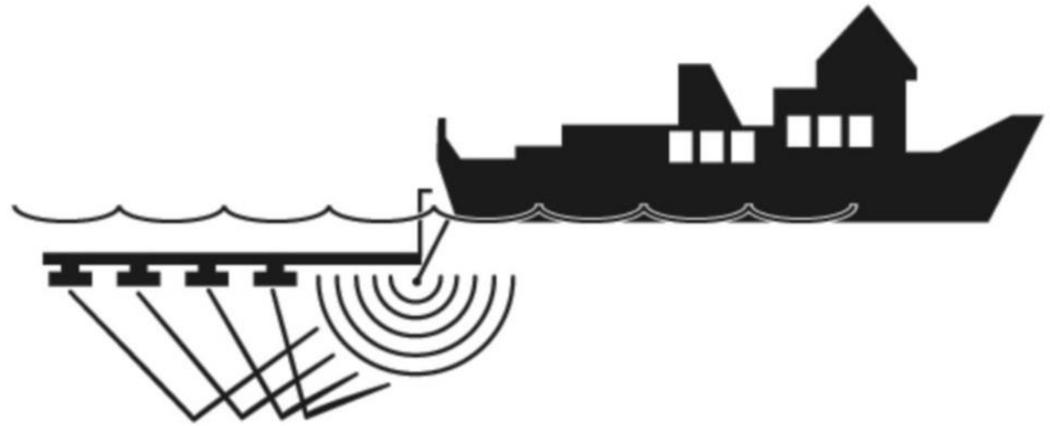


Seismic Technology

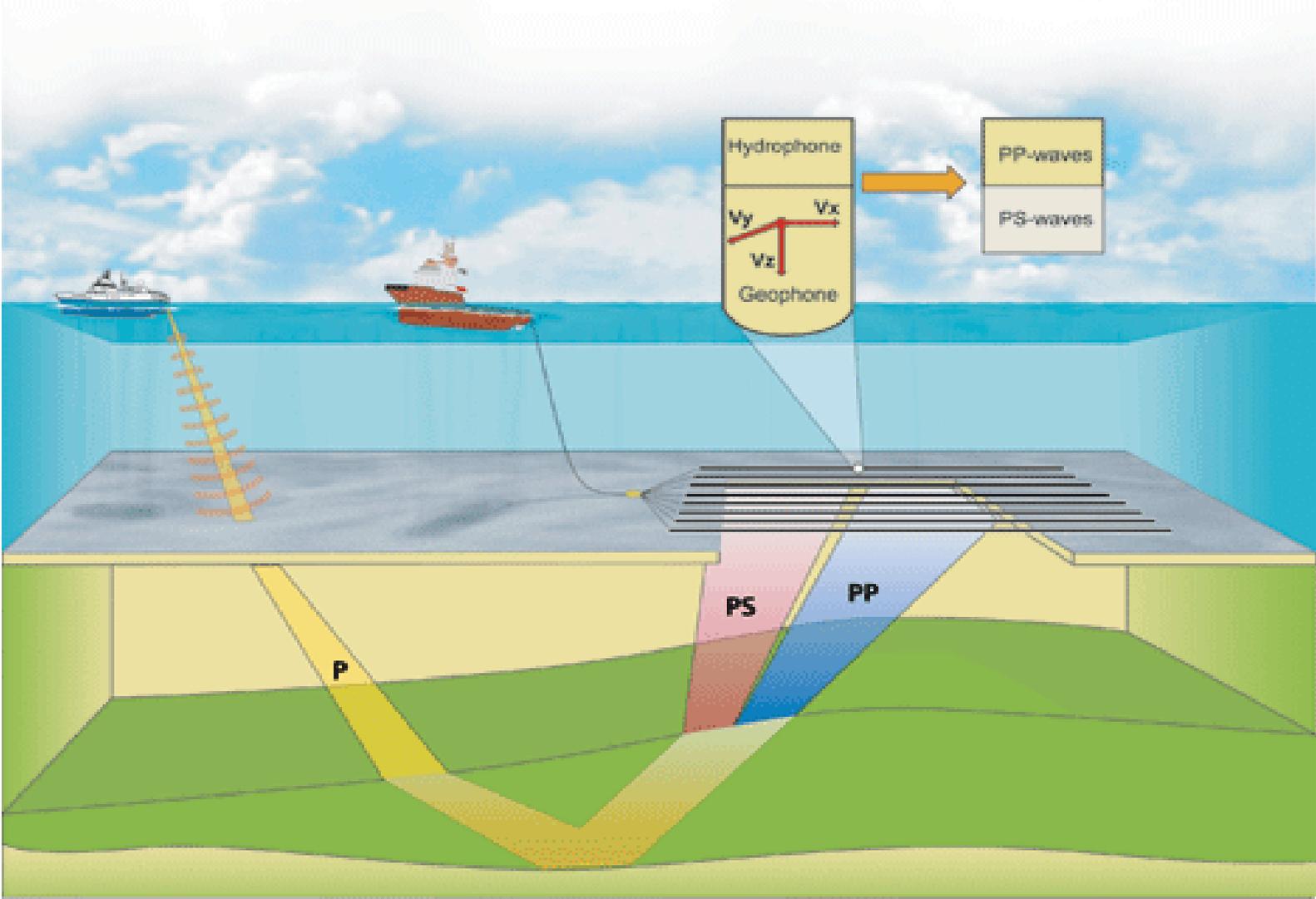
Land



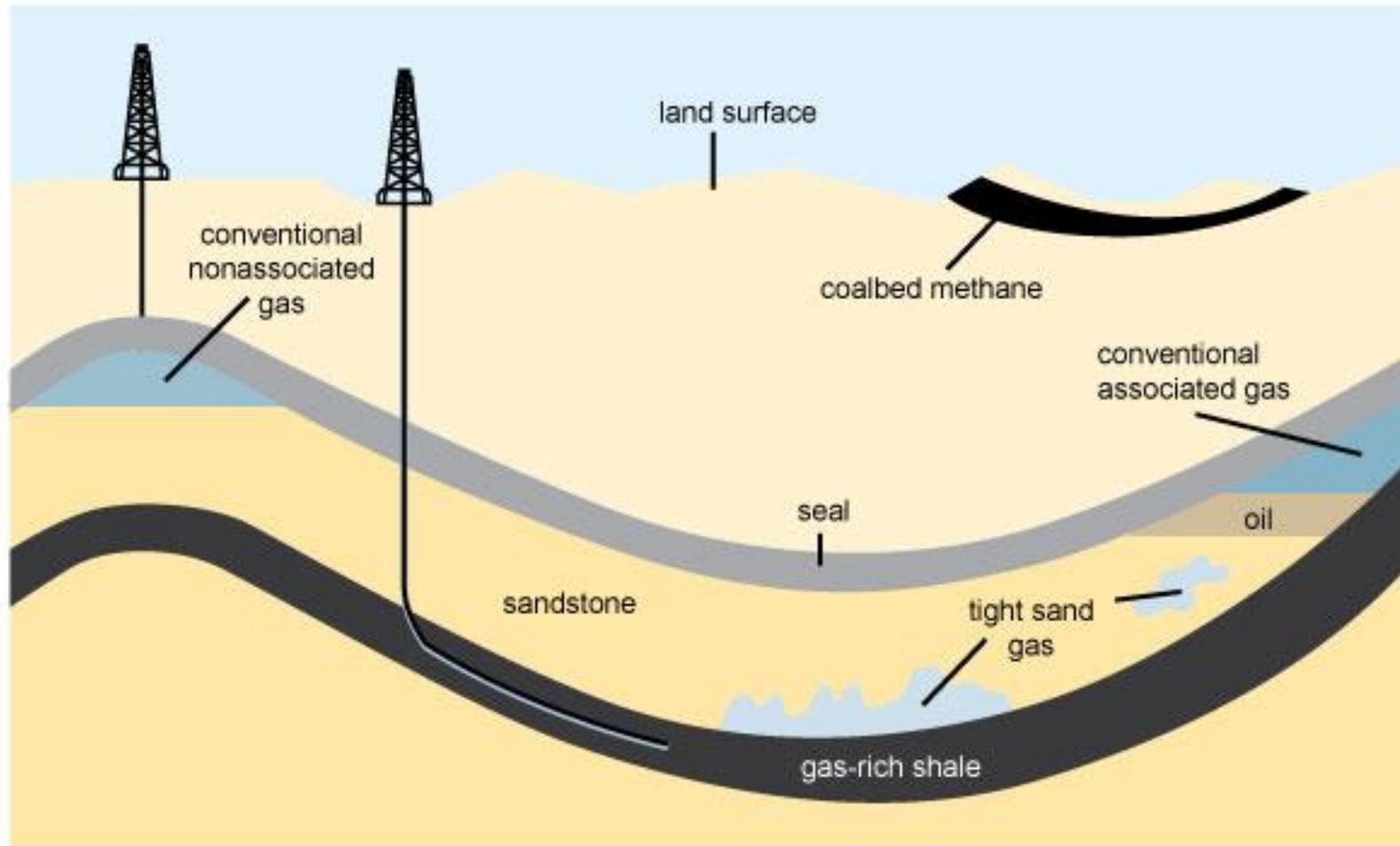
Water



Seabed Seismic



Schematic geology of natural gas resources



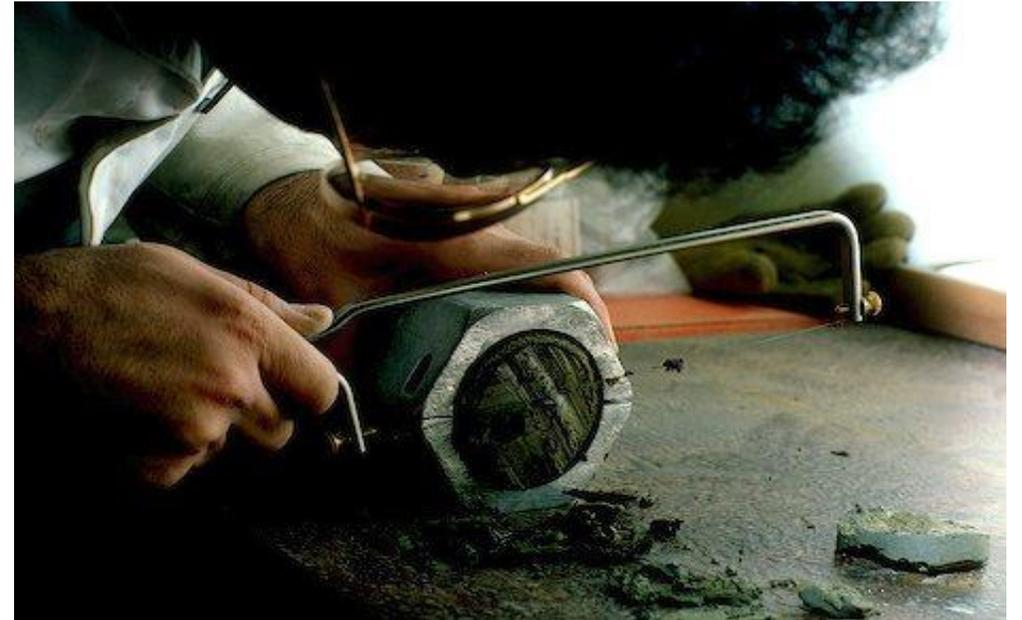
Source: Adapted from *United States Geological Survey factsheet 0113-01* (public domain)



Visualization



Core Samples





Exploration and Production by Drilling

Drilling Process

Place the drill bit, collar, and drill pipe in the hole.

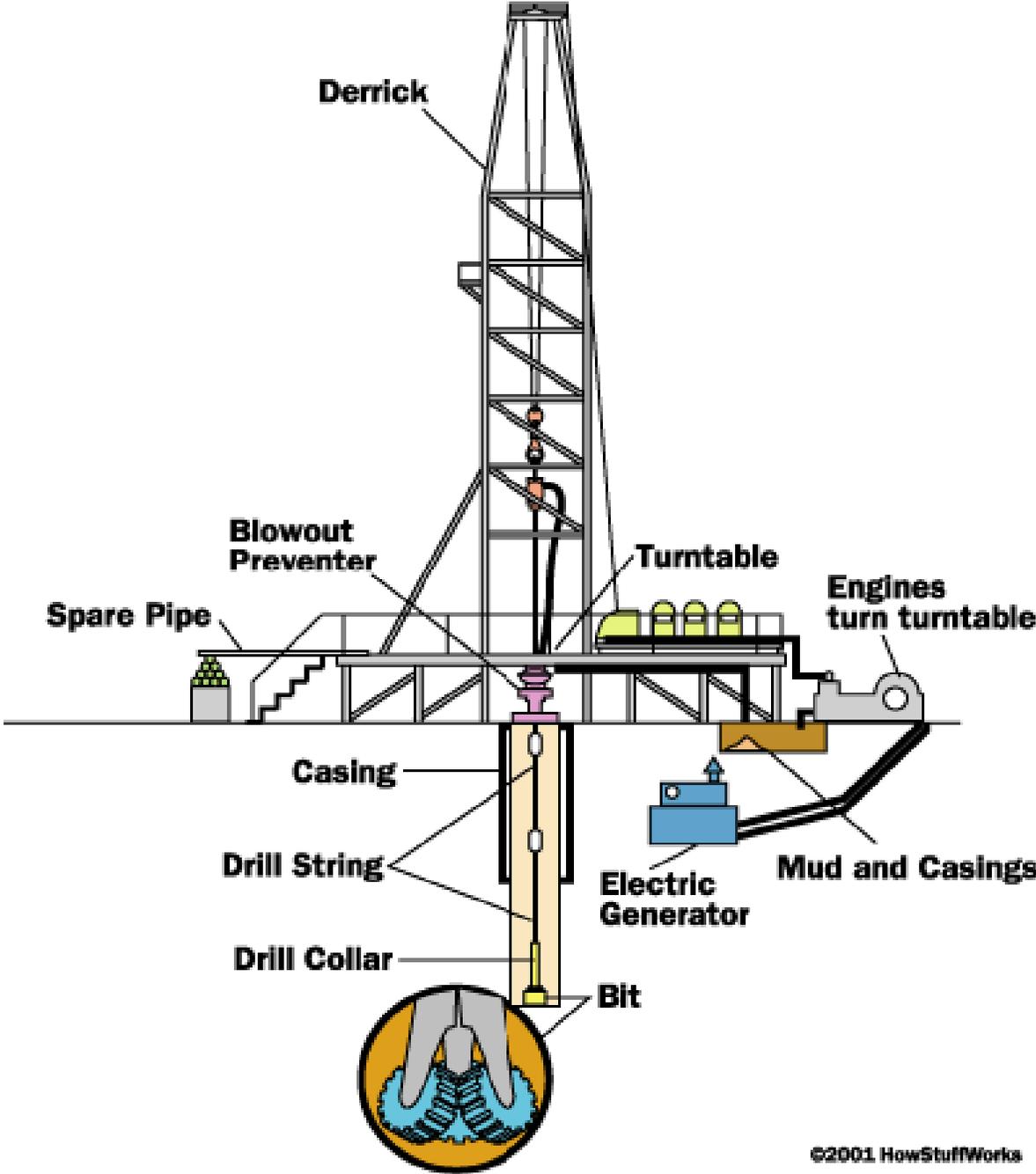
Attach the kelly and turntable and begin drilling.

As drilling progresses, circulate mud through the pipe and out of the bit to float the rock cuttings out of the hole.

Add new sections (joints) of drill pipes as the hole gets deeper.

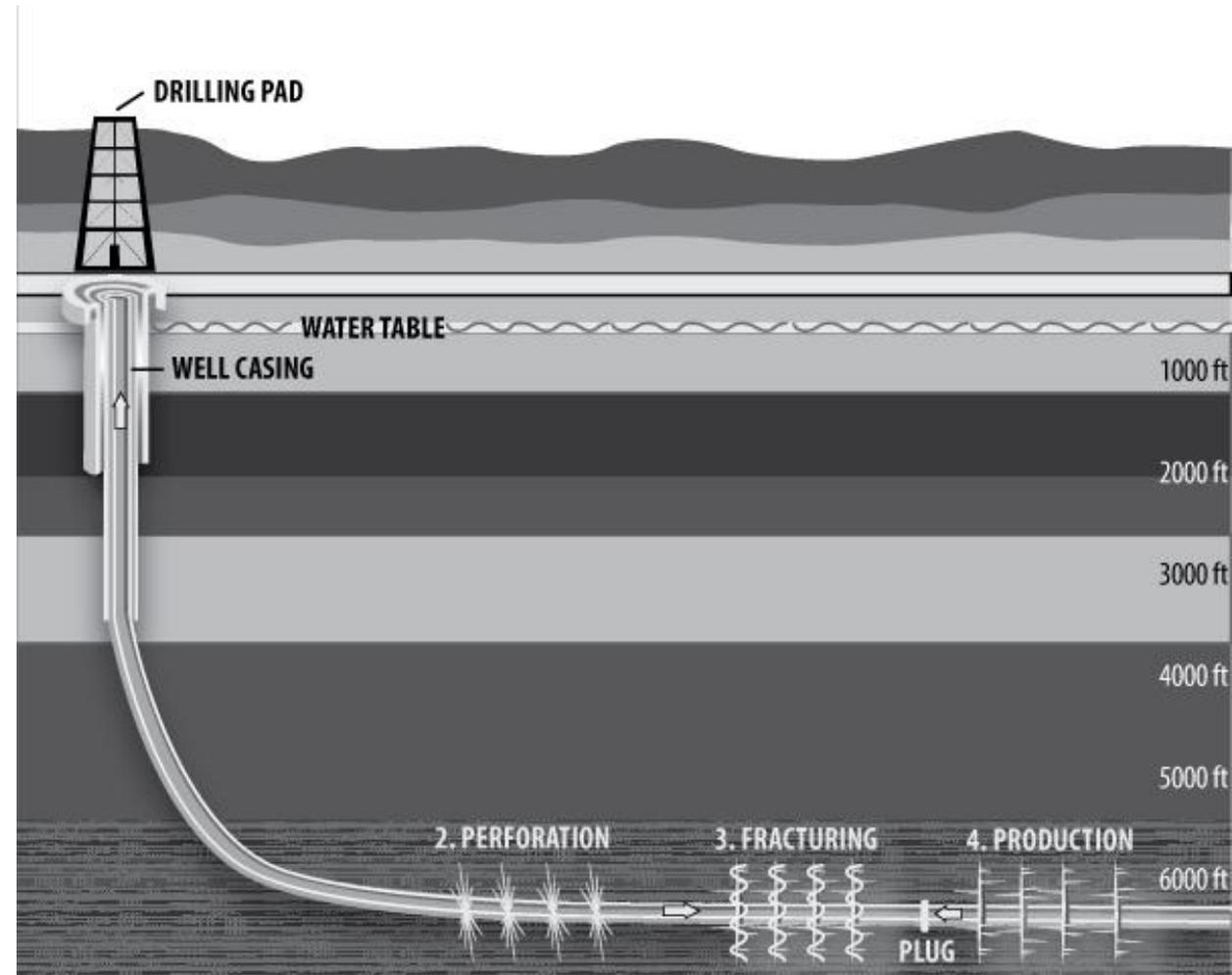
Remove (trip out) the drill pipe, collar and bit when the preset depth (anywhere from a few hundred to a couple thousand feet) is reached.

Parts of a Well



Horizontal Drilling and Hydraulic Fracturing

- Increased technology allows us to retrieve “tight” formations.
- The drilling process is similar, except for a specialized bit that allows for horizontal drilling.
- If oil and gas are trapped, fracturing may be used to allow liquids to flow.



Production

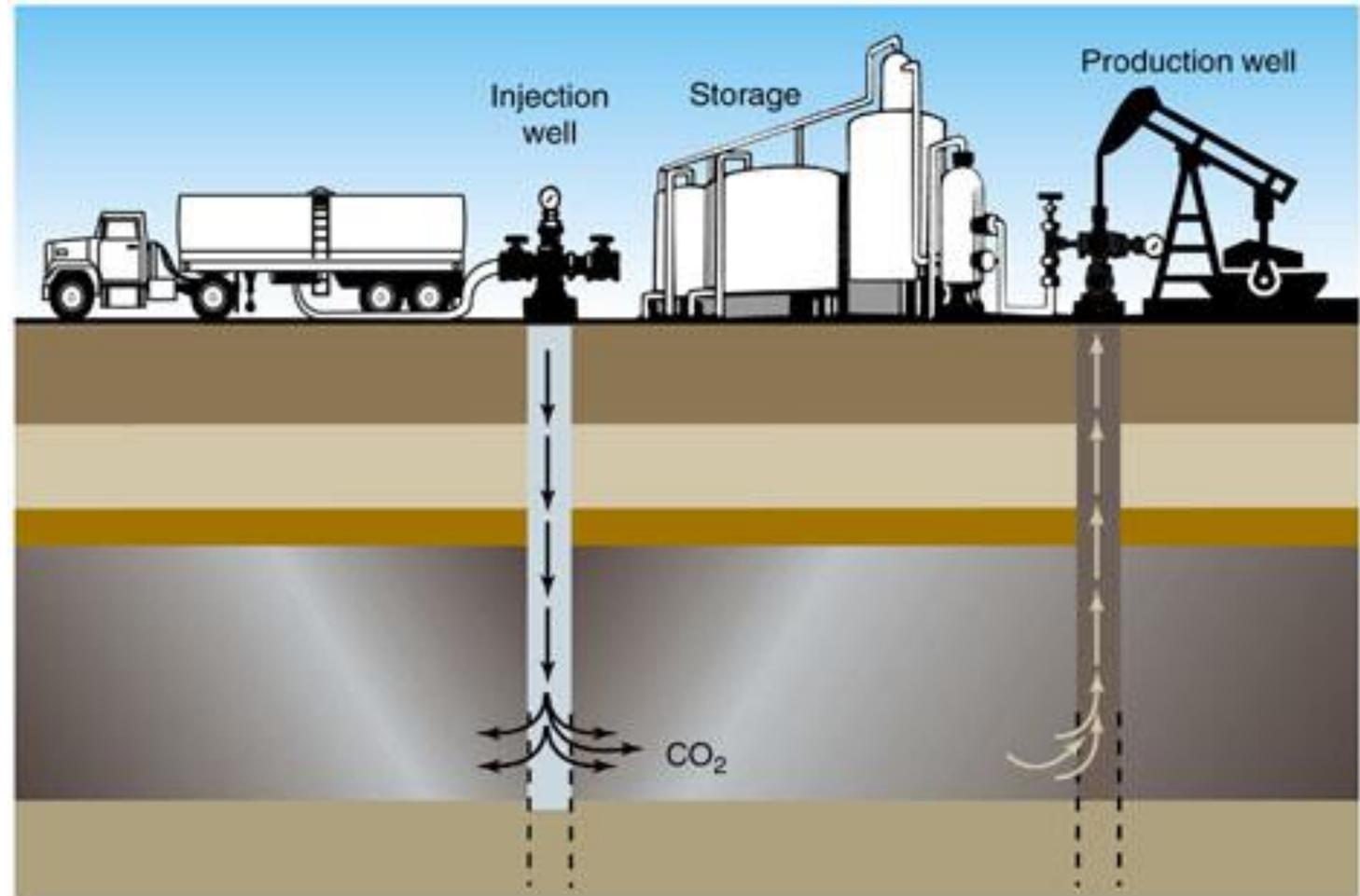
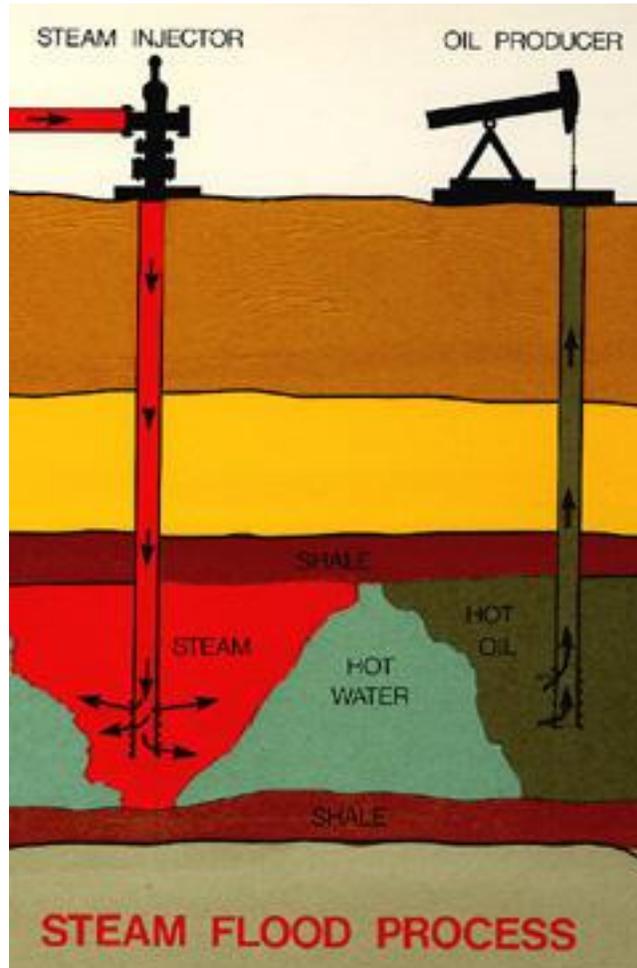


Christmas Tree



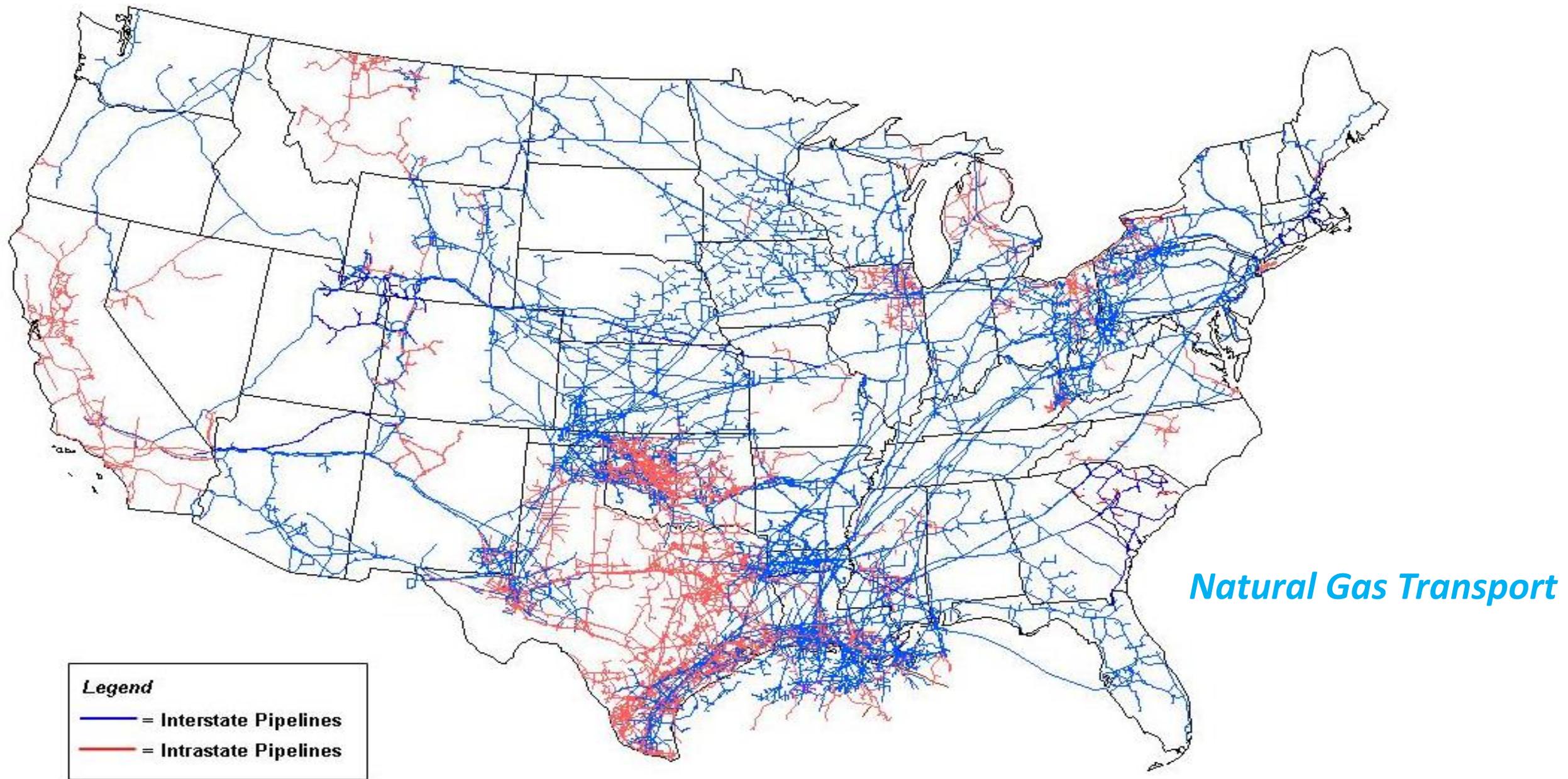
Horse Head Pump

Enhanced Oil Recovery



Oil Transport



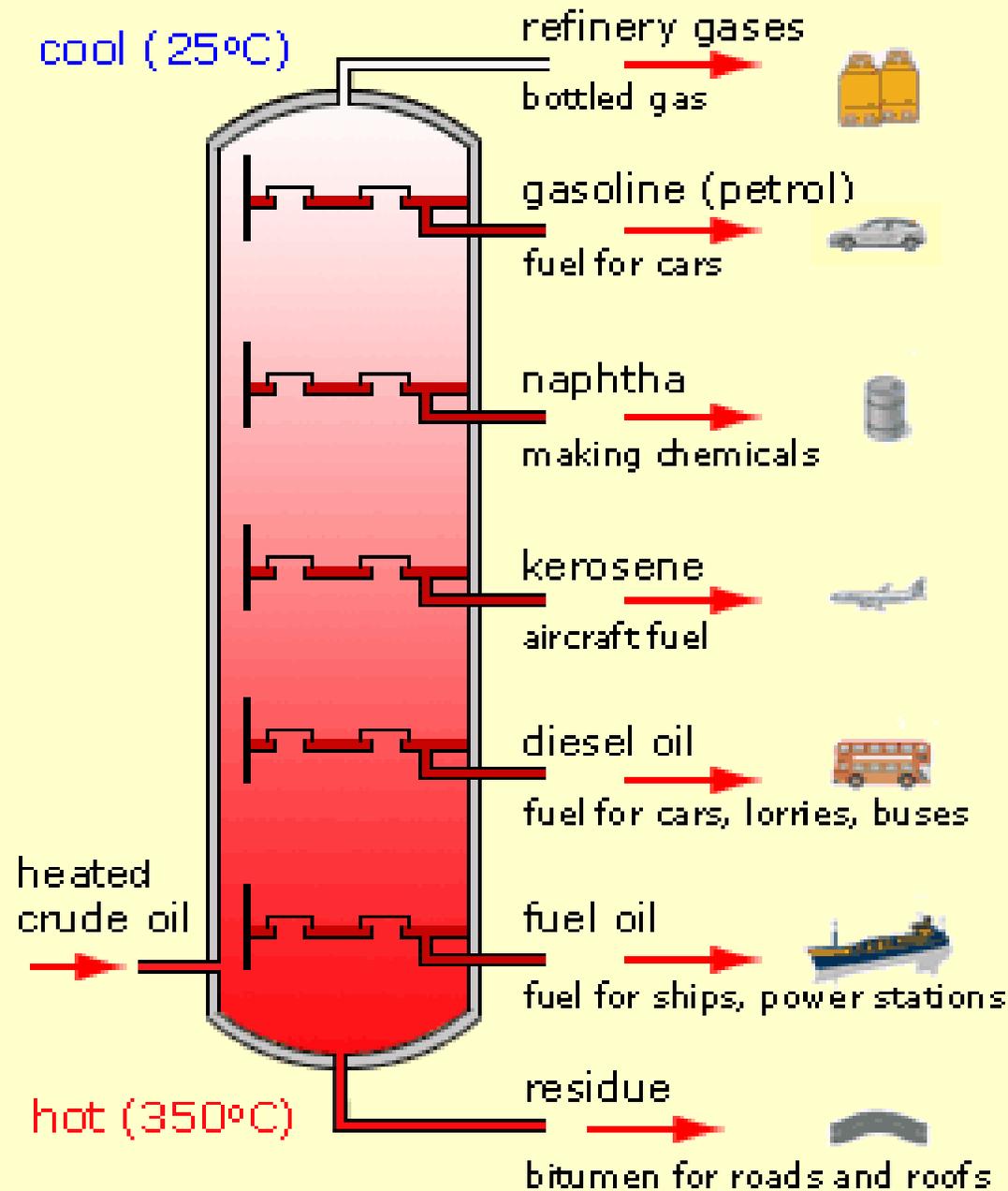


Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System



Refining of Petroleum

Fractionating Tower



small molecules
low boiling point
very volatile
flows easily
ignites easily

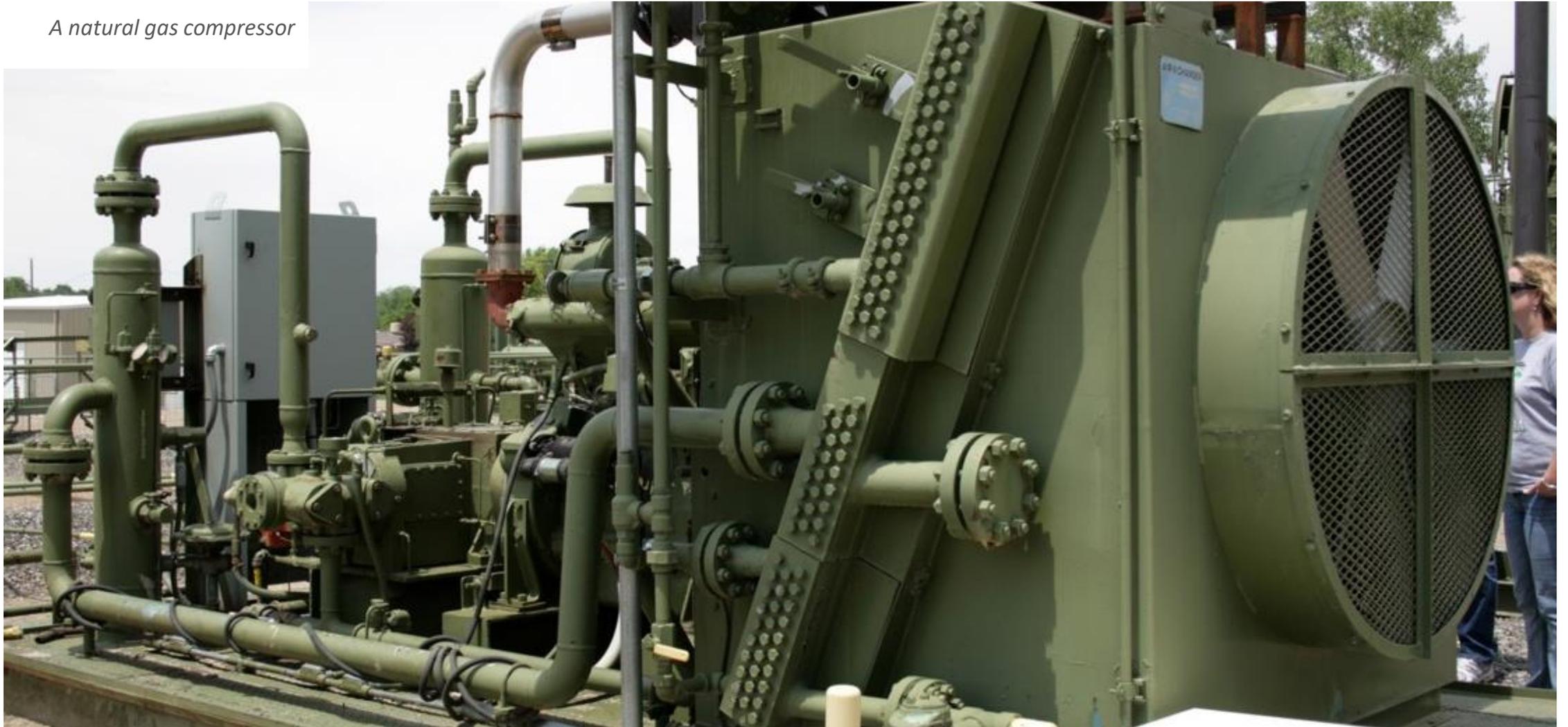
large molecules
high boiling point
not very volatile
does not flow easily
does not ignite easily

Petroleum Products



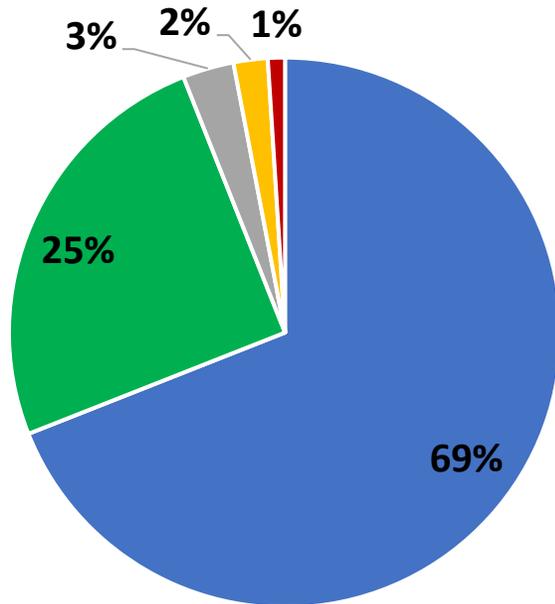
Processing of Natural Gas

A natural gas compressor



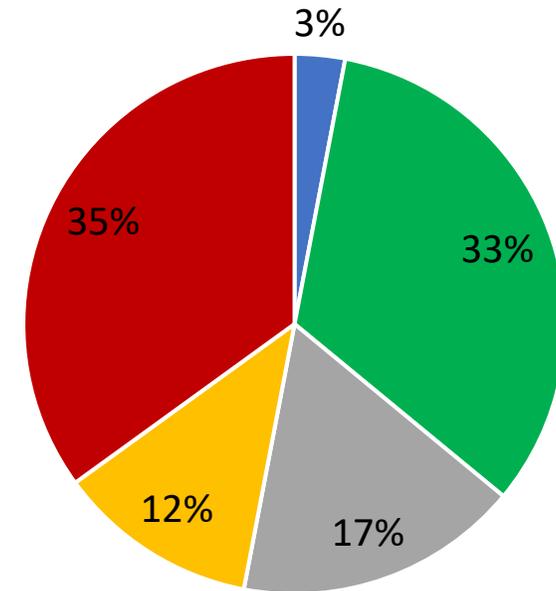
Uses of Petroleum and Natural Gas by Economic Sector, 2018

U.S. Petroleum Consumption by Sector



■ Transportation ■ Industrial ■ Residential
■ Commercial ■ Electric Power

U.S. Natural Gas Consumption by Sector



■ Transportation ■ Industrial
■ Residential ■ Commercial
■ Electric Power

Summary of Oil and Natural Gas

Advantages

- Widely available
- Simple combustion process can directly heat or generate electricity
- Inexpensive
- Easily distributed—good infrastructure in place
- High energy content

Disadvantages

- Nonrenewable
- Greenhouse Gases(CO₂)
- Air pollution (byproducts released during combustion)
- Price instability and costs rising
- Reliance upon imports
- Environmental impacts

For More Information

The NEED Project

- www.need.org
- info@need.org
- 1-800-875-5029

Energy Information Administration

- U.S. Department of Energy
- www.eia.gov



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