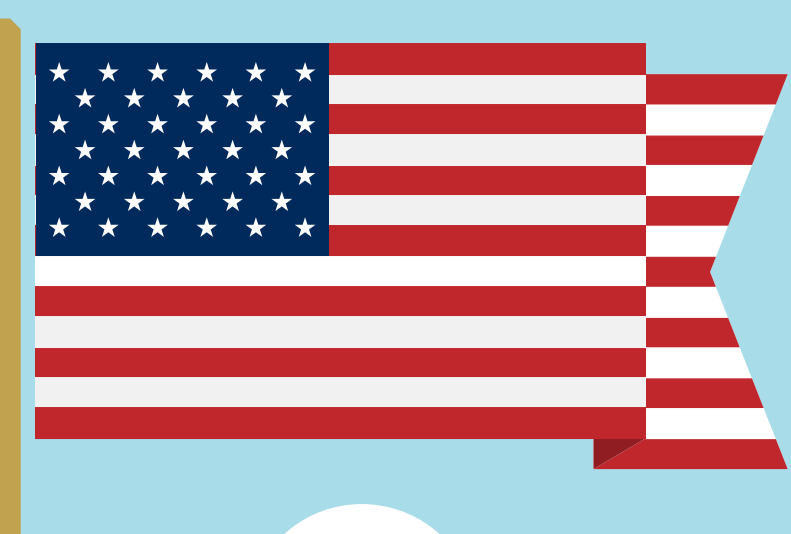


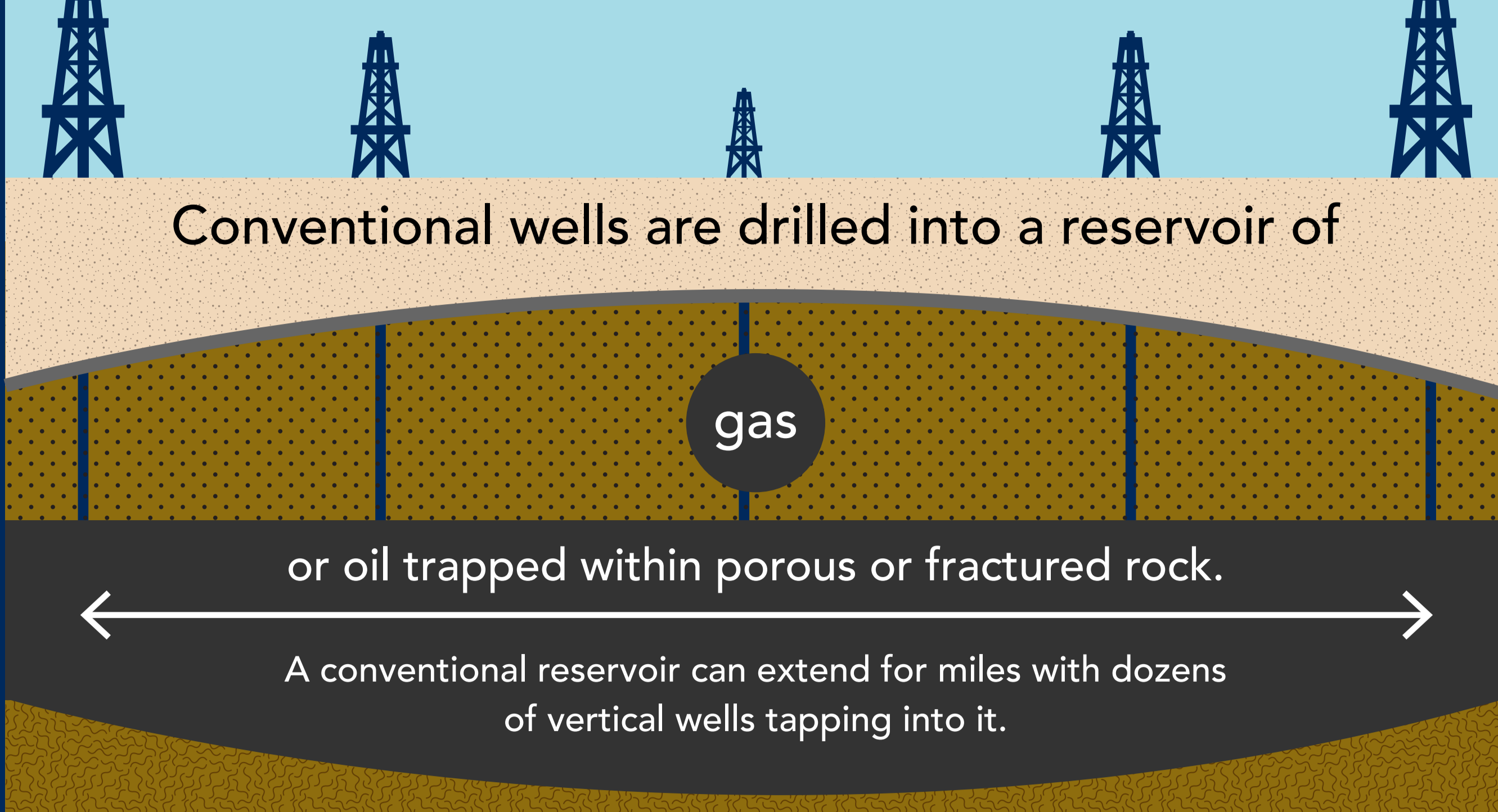
HYDRAULIC FRACTURING



Fracturing, or fracing, has been used in oil and gas development for decades. Recently, fracturing has played a vital role in freeing up resources and helped drive a remarkable expansion of American energy supplies.

CONVENTIONAL VS. UNCONVENTIONAL DRILLING

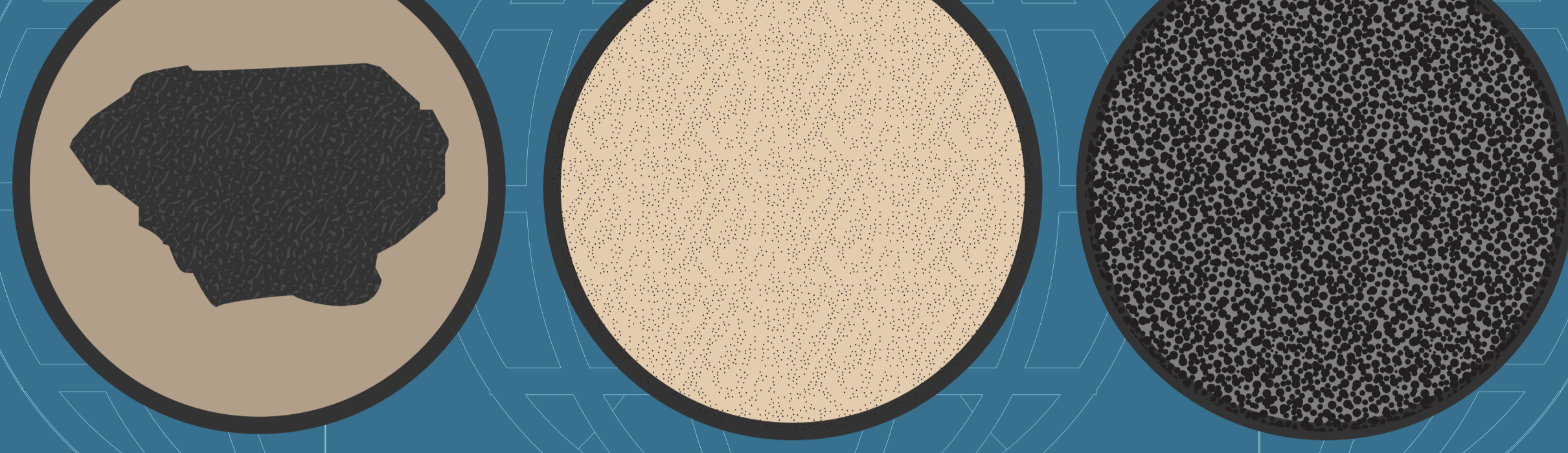
Conventional oil and gas wells have been drilled



New reservoirs are hard to find and can be in difficult locations or offshore under two miles of water.



Unconventional oil and gas wells can be found in



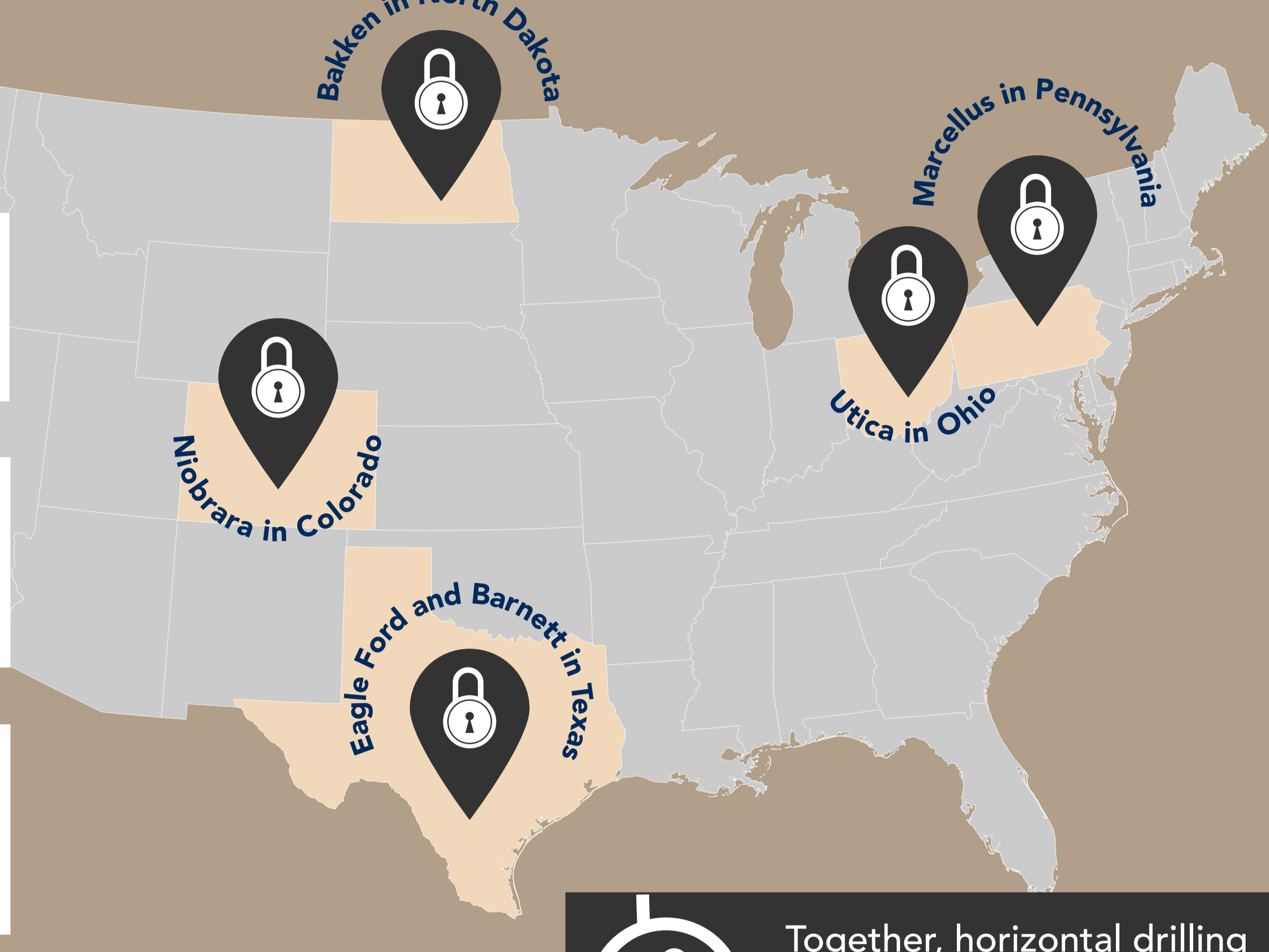
shale oil, heavy oil, and tight oil formations.

Tight oil unconventional formations in the U.S.

These formations have long been known to hold oil and gas, but only recently have the keys to unlocking them been uncovered.

Advancements in horizontal drilling and better fracturing techniques provide the keys to unconventional development.

Fracturing creates and then holds open tiny cracks, or fractures, in solid rock formations. Oil and gas can then flow through the cracks and up the well to be recovered at the surface.



Together, horizontal drilling provides the keyhole and hydraulic fracturing turns key in the lock.

One unconventional well



is an investment of between \$8 million and \$12 million, far more than a traditional well.

HOW TO FRACTURE A WELL



Successful tight oil wells were first drilled in the Barnett Shale in the late 1990s.

Modern horizontal drilling techniques allowed wells to be drilled thousands of feet down and additional thousands of feet out through a layer of shale or other hard rock that might be just 50 feet thick.

After drilling, you'll need:

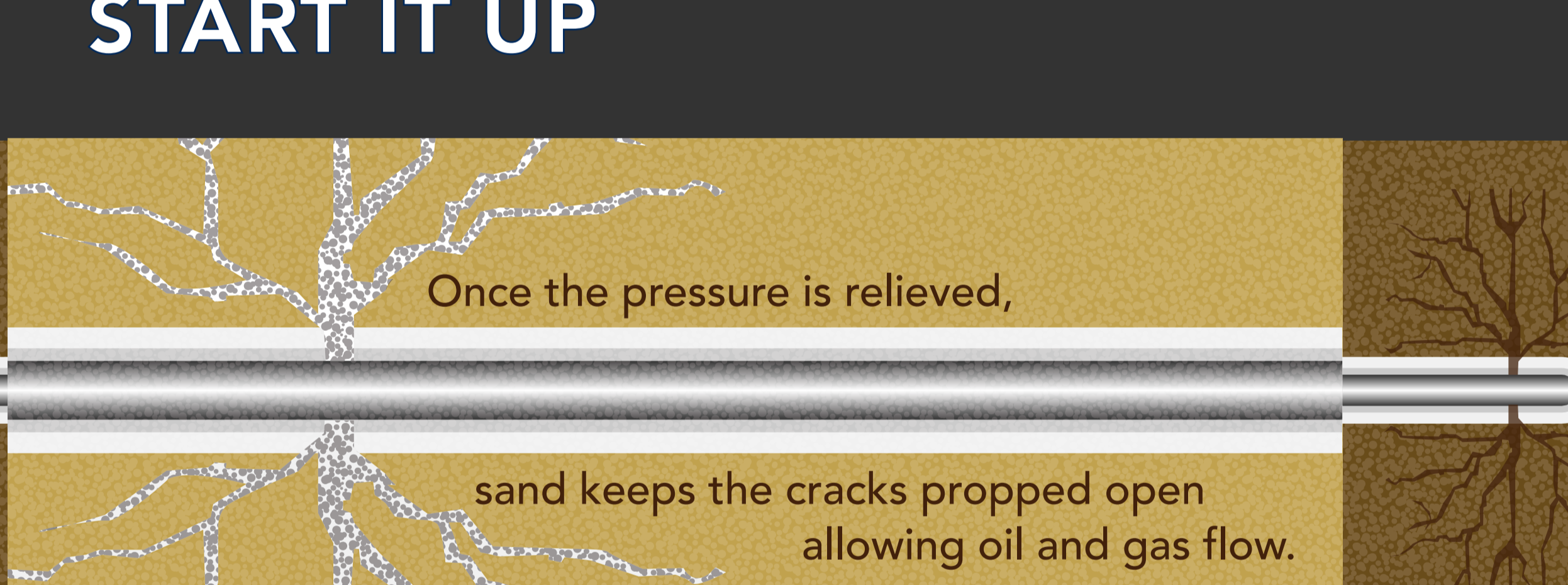
- 1 Portable water storage tanks for 2 to 5 million gallons of water.
- 2 Several tons of special frac sand.
- 3 Small amounts of specialized chemicals.
- 4 A dozen or so workers.
- 5 Generators, pumps, hoses and advanced control equipment.



and reliable, efficient service companies to provide specialized services.

START IT UP

The water, sand and trace amounts of chemicals are pumped under very high pressure down the wellbore causing tiny cracks in the rock



HOW TO PROTECT GROUNDWATER

During drilling, the well is isolated from the surrounding layers of rock.

The driller lines the wellbore with concentric layers of cement and steel pipe.

The finished wellbore is pressure tested to make sure the seal is tight.

HOW TO MAKE FRAC FLUIDS

Combine water with a very small amount of some specialized chemicals to create fracturing fluid. Engineers provide the exact portions depending on the characteristics of the rock.

- Acids** like those used in swimming pools, scrub the rock face before fracturing.
- Biocides** similar to medical disinfectants, prevent bacteria build-up in the water.
- Corrosion inhibitors** also found in paints and coatings, prevent rust formation.
- Friction reducers** also used in water conditioners, help fluids move more freely.
- Gels** also found in ice cream and salad dressing, hold the sand in suspension.
- Breakers** similar to table salt, dissolve the gels allowing fluids to flow back to the surface.



Want to know more about chemicals used in fracing? FracFocus is a national registry for hydraulic fracturing. It manages a database of all chemicals used for hydraulic fracturing. Sixteen states require companies disclose on FracFocus the chemicals used on each well.

WHAT SPECIALIZED SERVICES ARE NEEDED?

These may include trucks to haul water and materials, power generators, satellite uplinks and frac water heating.



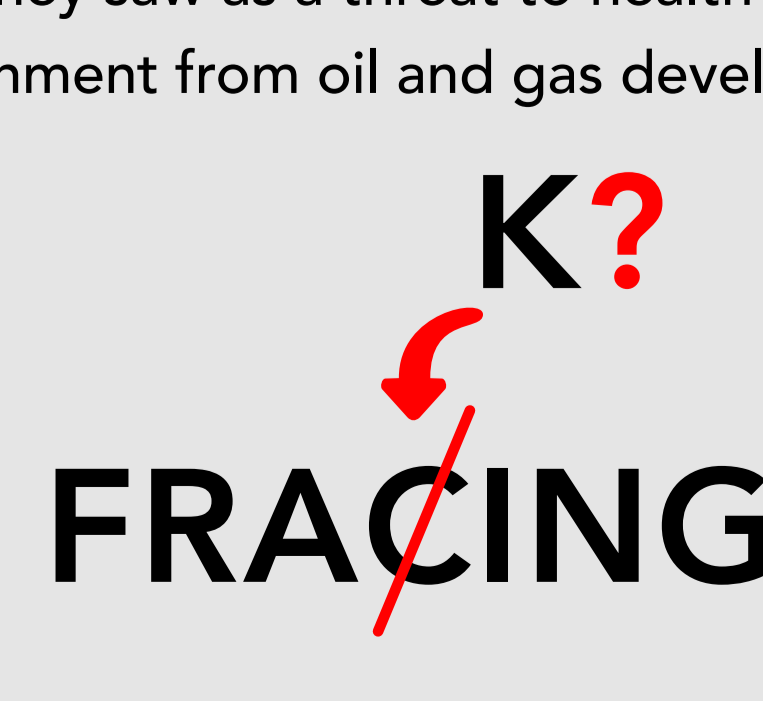
Frac Water Heating and Frac Fluids Heating Services provide specialized on-location assistance.

- Prevent water from freezing during cold weather
- Maintain proper well temps to prevent metal cracking
- Operator specific cross-linked gel frac formulas

Services like frac water heating are a crucial part of any frac job. Operators rely on frac fluids heating service companies to provide flexible, efficient solutions to the challenges they face with every new project.

WHAT IS THE DIFFERENCE BETWEEN FRACING AND FRACKING?

The industry uses the term to fracing, or sometimes frac'ing, as a shortened form of hydraulic fracturing. In the mid-2000s, some organizations spelled it fracking to describe what they saw as a threat to health and the environment from oil and gas development.



[FRAK-ING]
noun
1. a process in which fractures in rocks below the earth's surface are opened and widened by injecting chemicals and liquids at high pressure; used especially to extract natural gas or oil.
Since then, fracking has become a catch-all to describe, and to malign, the entire oil and gas industry. Natural gas is sometimes referred to as "fracking gas" even though gas produced from a tight formation is no different from gas produced from other types of wells. Spelling the word with a "k" has become so widely accepted that the term fracking was added to the Merriam-Webster dictionary in May, 2014.

Coloradans for Responsible Energy Development
One industry-supported education program, Coloradans for Responsible Energy Development (CRED), acknowledged that the term fracking is more widely found in Google searches than when searching for "fracing." CRED spells it fracking because: "We felt our time was better spent educating Coloradans on the issue, not arguing about whether or not to include the "k."

Information provided by:



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