Introduction to Fossil Fuel Drilling and Fracking

Fossil fuel drilling

Companies drill for crude oil and natural gas to depths of 3,000-8,000 m. Drillers use bits made of tungsten carbide steel or diamond that are strong enough to cut through rock. Throughout the drilling, mud is poured down the hole to keep the drill bit cool and to allow loose rock fragments to float up to the top. Cement is poured on the outside of the metal casing to prevent leakage of fossil fuels into the water supply. Metal casing holds up the walls of the drill hole and allows for oil and gas to flow to the surface. Pumping begins when the drill reaches the bottom of the rock containing fossil fuels. Pumping draws fossil fuels from the rock up to the surface (Figure 1). This is called primary recovery.

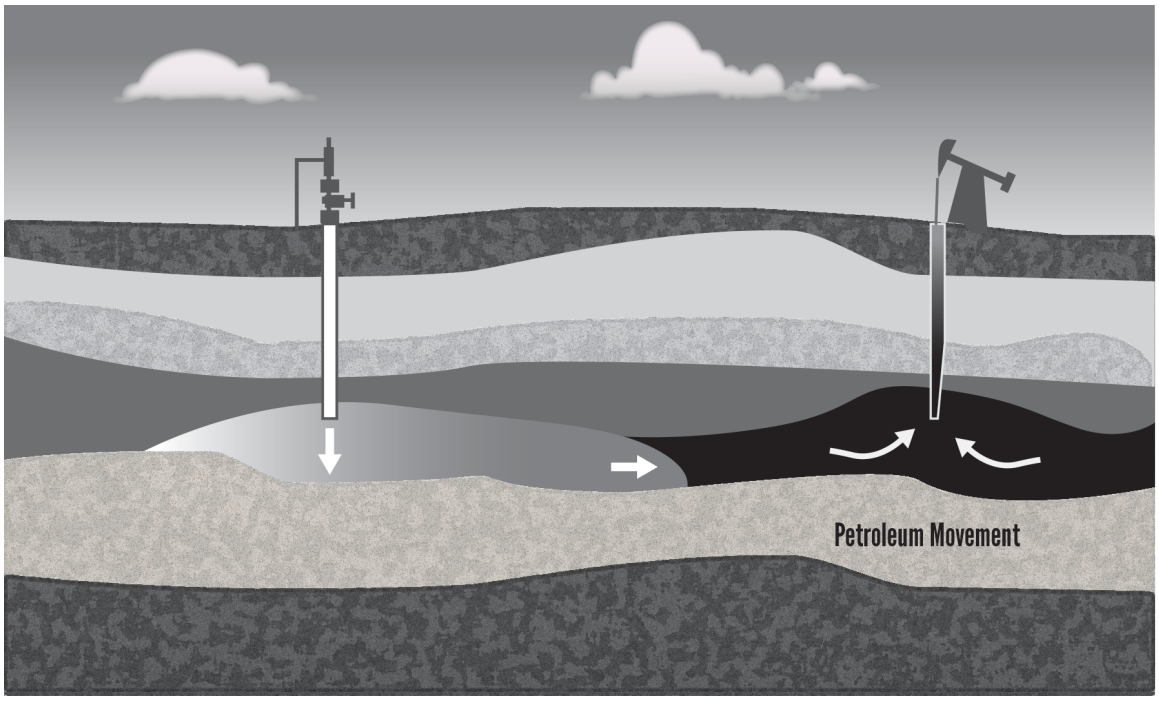

Figure 1. Pumps pull oil and natural gas from the rock to the surface, such as on the right side of this figure. Credit: Wright Seneres

How are fossil fuels removed from rock?

Rock containing organic material gets buried over millions of years. Pressures increase as the rock is buried deeper, causing the organic material to turn into crude oil and natural gas. Drillers call this fossil fuel layer source rock. High pressure on source rock can cause oil and gas to move through fractures and small pore spaces into adjoining rocks. Drillers call this reservoir rock. When pores are connected, oil and gas flow easily (Figure 2). Geologists call this type of rock permeable. However, when the pores are not well connected, the oil and gas do not flow easily. Geologists say that this type of rock is non-permeable (Figure 2).

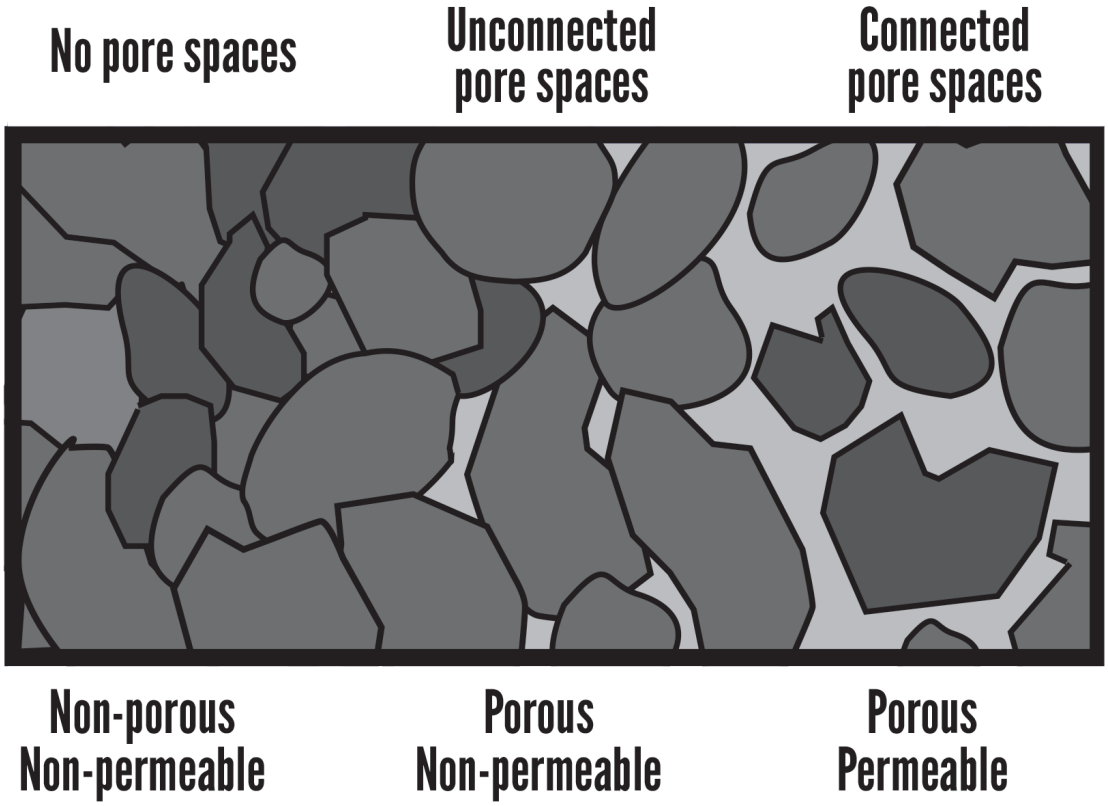

Figure 2. Illustration of porosity and permeability. Credit: Wright Seneres

Drillers look for a reservoir rock layer that is covered with a non-permeable rock layer called a caprock. The caprock traps the oil and gas. Drillers search for reservoir rock filled with oil and natural gas (Figure 3).

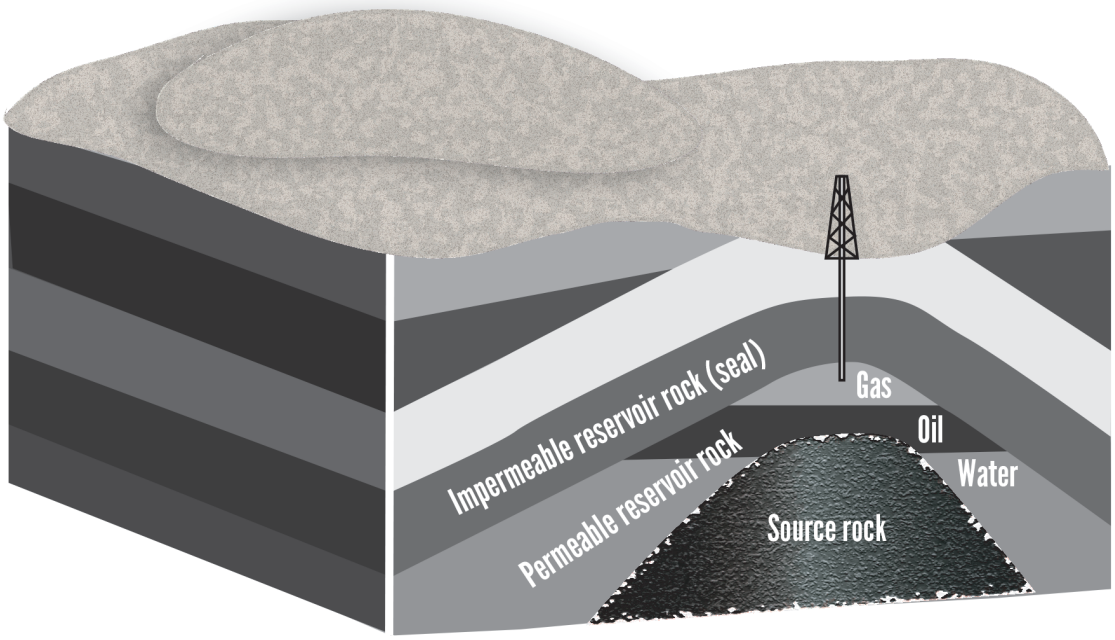

Figure 3. Oil and natural gas rock formations common in conventional drilling. Credit: Wright Seneres

Not all of the oil and natural gas is removed during primary recovery. Alternative methods are used to increase yields.

What is fracking?

Hydraulic fracturing, more commonly called fracking, is the use of water, sand and chemicals under high pressure to break rock and release fossil fuels (crude oil and natural gas) trapped in pores spaces. Fracking creates new fractures in the rock, increasing the rock's permeability (Figure 4).

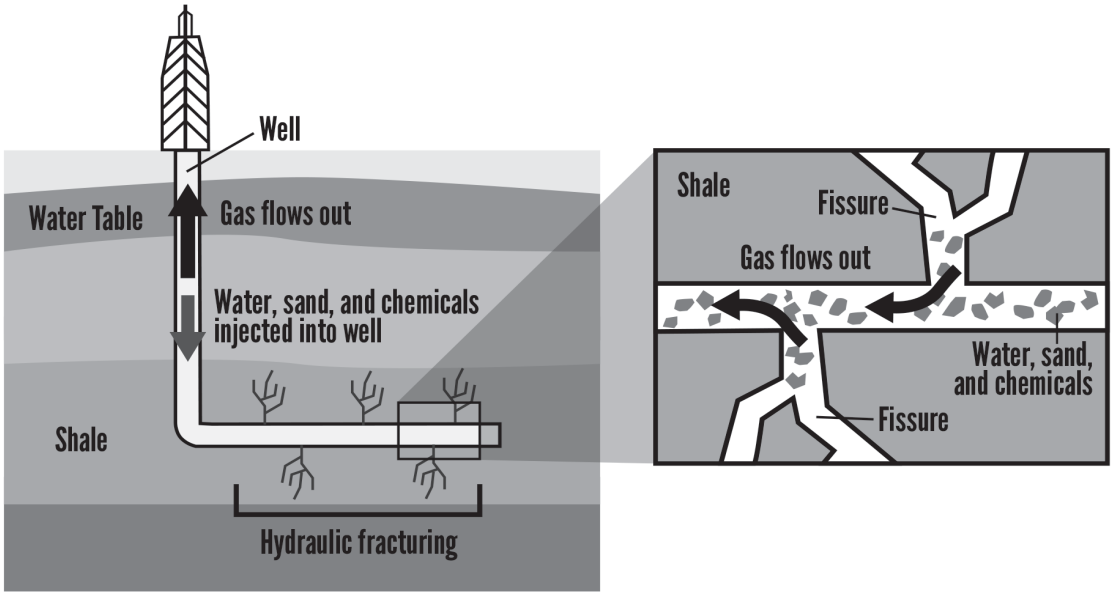

Figure 4. Fracking schematic. Credit: Wright Seneres

Fracking increases production by pulling oil and natural gas from source rock that would otherwise stay trapped in the ground because of limited pore spaces. Recent increases in oil and gas production due to fracking has decreased the amount of oil and gas the United States imports from other countries.