

Unconventional Resources

The term “unconventional resources” is becoming widely used in public discussions. But what are unconventional resources? Simply put, they are oil and gas resources that require specialized well completion techniques to produce. The most common techniques include horizontal drilling and hydraulic fracturing. Unconventional resources include oil and gas found in shales, oil and gas in low permeability sands, and gas found in coal seams. These are referred to as shale oil, shale gas, tight oil, tight gas, and coalbed methane, respectively. Unconventional resources are found in unconventional reservoirs.

Conventional petroleum reservoirs contain oil and gas that has migrated from the rock where they were created. Oil and gas are created in shales and coals and migrate to rocks like sandstones, limestones, and dolomites.

The major difference between unconventional and conventional reservoirs is permeability of the reservoir. Permeability is defined as the ease with which fluid can flow within a reservoir. A high permeability indicates fluid can flow easily through a reservoir. Conversely, low permeability indicates fluid has a hard time flowing through a reservoir.

Methods commonly used to evaluate conventional reservoirs cannot be used to evaluate unconventional reservoirs. This is due to the extremely low permeabilities of unconventional reservoirs. In conventional reservoirs, pressures are always attempting to equalize throughout the reservoir by the movement of fluids from one part to another. Equations used to calculate reservoir performance depend on this assumption. In unconventional reservoirs the permeability is so low that pressures cannot respond to fluid movement within the time frames of production. Therefore, unique methods have been developed (and are still being developed) to analyze and predict the performance of unconventional reservoirs.

The most common method used to predict the performance of unconventional oil and gas reservoirs is the “type curve” method. This method can be used for shale oil, shale gas, tight oil, and tight gas. To use this method, the production is plotted and a hyperbolic curve is fit through the data. The result of this approach is a type curve that can be used as a basis to predict the performance of wells drilled offsetting the producing well. If the producing well (or wells) used to develop the type curve is

horizontally drilled, a normalized type curve is developed by dividing by the length of the horizontal section (known as the lateral length). This normalized curve can then be used to estimate production for future offset wells by multiplying by the expected later length. If the producing well (or wells) used to develop the type curve is vertical with multiple intervals, a normalized type curve is created by dividing by the thickness that was hydraulically fractured. Similarly, this normalized type curve can be used to predict performance of future offset wells based on the expected thickness of the zone.

The method used to estimate the performance of coalbed methane (CBM) reservoirs is based on pilot wells. Pilot wells are drilled and produced specifically to determine the ability of CBM reservoirs to produce gas. CBM reservoirs contain gas and water. In almost all CBM reservoirs the pore space is filled with water and the gas is adhered to the surface of the coal. Until water is removed from the pore space, no gas is able to detach from the coal surface. Therefore, water must be produced to open up pore space for the gas to flow. Pilot wells are drilled on a small acreage pattern to quickly remove water from the CBM reservoir and allow gas to flow. Based on the spacing, the amount of water and gas produced, and the time it takes, a CBM model can be created. This model can then be used to determine the optimum well spacing required to develop the reservoir.

Aeon Petroleum Consultants has reviewed 10's of thousands of type curves from every major basin in the United States. We have also been involved in analyzing CBM reservoirs all over the World from pilot programs to mature development. Aeon Petroleum Consultants can handle any unconventional resource evaluation your company requires.