

## Study on Coalbed Gas Reservoir Engineering

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*Abstract: Coalbed methane production capacity is an important indicator of the merits and demerits of coalbed methane wells, and the productivity of coalbed methane wells directly affects the economic benefits. How to accurately predict the coalbed methane production capacity is the key problem that the coalbed gas field needs to be solved urgently for the purpose of efficient development. The mechanism of coalbed methane production is different from traditional oil and gas reservoirs, and it is of great significance to explore the establishment of coalbed methane reservoirs for coalbed methane development.*

*Keywords: Coalbed methane, gas reservoir engineering, development mode*

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### 1. COAL SEAM GAS FIELD DEVELOPMENT PRINCIPLE

The CBM development plan should put forward the steps of capacity building in accordance with the principle of overall deployment, phased implementation and rolling development, and clarify the annual drilling workload and the workload of the ground staging construction, and provide the basis for the annual development index forecast and investment estimation. The development of well production, drilling, logging, well testing, completion, transformation, mining, ground gathering, purification, dynamic monitoring, gas field development and follow-up work to carry out specific implementation requirements <sup>[1]</sup> The principle of compiling coalbed methane development planning

(1) The overall development principles. The development plan for the preparation of a constituency should first be developed from the overall development of the strategic height, in full consideration of the economic rational development of coalbed methane resources and full and effective use of the pipeline network and other utilization of the project under the circumstances, to develop an overall development program.

(2) Rolling development principles. Regardless of the size of the investment, should start from the resource evaluation, the development of experimental start, and gradually expand the scale of development. The principle comes from the risk of CBM development.

(3) The principle of efficiency. Whether for the purpose of obtaining economic benefits or to ensure the safety of coal production for the purpose of its development plan must be able to obtain specific benefits for the planning of the fundamental principles. The principle of

efficiency is the soul of all development projects.

(4) Objective and pragmatic principles. The development plan should make the planning as practical as possible and have strong operability. This principle includes objectively evaluating the resource conditions, correctly estimating the sales market and making reasonable use of the various economic indicators and practicality of the development project. Production forecast. CBM development plan should be in the geological and gas reservoir characteristics clear, the implementation of reserves, the main development process technology under the clear preparation of the gas field development process, when the actual situation of the gas field and the original design is a big difference, or need to adjust the stage, Should be prepared gas field development adjustment program.

Coalbed methane development program adhere to the principle of low cost, high efficiency, to determine the effective development methods, well pattern deployment design. Drilling and completion of the process, preferably mining, low-pressure gathering and transportation and water treatment technology to determine a reasonable system of mining, control the development of investment. CBM development program should follow the principles of health, safety and environmental protection, comply with relevant national laws and regulations [2].

## **2. THE CHOICE OF DEVELOPMENT MODE**

The mining mechanism of coalbed methane is fundamentally different from conventional gas storage. There are three states of natural gas that occur in the coal seam, that is, the free state, the adsorption state and the dissolved state, and there is little or no free gas. Most of the cracks in the coal seam are saturated with water, even if there are some free gas, most of which are also adsorbed on the surface of coal. When the coal pressure drops to the critical value of the desorption pressure of the coalbed methane, the adsorbed CH<sub>4</sub> in the coal begins to separate from the microporous surface, called desorption. Due to the reduced pressure in the cleavage, the desorption can also occur at the interface of the coal seam. The desorbed gas flows through the bedrock and micropores into the fractured network and flows through the fractured network to the wellbore [3].

According to the gas reservoir thickness stability, structural characteristics, physical characteristics such as cable, choose a reasonable development methods, such as drainage gas production or other development methods. The Qinshui Basin is more suitable for the development of vertical wells and directional wells in the ground. In other areas, due to the complicated geological conditions, it is suggested that the coalbed methane exploration and development should be carried out. Because the mechanism of coalbed methane extraction is different from that of conventional gas reservoirs, only when the reservoir pressure is reduced, the process of desorption-diffusion-seepage can flow from the surface of coal particles to the wellbore, and the coal fissures or cleavage are filled with water, Fissure and grouting are the main migration channels in the coal seam, and the coalbed methane needs to be produced by drainage (fracture or cut) pressure (coal rock reservoir). Therefore, the production process of

coalbed methane is the process of step-down drainage the and the pressure interference between the coalbed methane wells is favorable for the formation of water drainage. Because the pressure funnel of the CBM wells is overlapped and overlapped, the pressure drop in the overlapping area is the sum of the pressure drop, and the pressure in the overlapping area can be reduced to a very low level, Which can cause most of the coalbed methane desorption within the well, not only to improve single well production, but also increase the total gas production. Horizontal well construction there is a risk, should be based on the exploration of coal seam, the detailed implementation of the stage. The thickness of coal seam is more than 2.5m, the depth of gas reservoir is shallow, the formation is only a few folds, and the fault is not developed. Horizontal well mining can be considered. At present, more and more horizontal wells are used in the field of coalbed methane, including single and multi-branch wells. Horizontal well development technology has many advantages over straight wells: the use of multi-branch horizontal well development technology, can reduce the number of drilling and reduce the overall cost. Practice shows that with the horizontal well technology matures, the current level of oil and gas reservoirs in the current cost of oil production than the vertical well, both to improve the economic efficiency, make full use of resources. However, due to the high cost of the equipment in the country, the development of high risk, horizontal wells mining coalbed methane has a certain degree of adaptability, not any coal seam are suitable for<sup>[4]</sup>. For different coal seams, such as thin thickness, developmental dispersion or thickness and the coal seams with strong changes in production are not suitable for horizontal wells.

### **3. DETERMINATION OF REASONABLE WELL PATTERN PARAMETERS**

#### **3.1 Well density**

The location of the well should be considered for the geological characteristics of the reservoir, the distribution of the reservoir, the degree of control reserves, Coalbed gas reservoirs should also focus on the direction of coal fissures, especially for coal fractures with strong directional fissures Gas reservoirs, cloth wells on the development of the impact of the effect is even more significant. Coal seam gas field wells are usually used Square and plum blossom.

#### **3.2 Well design**

For low permeability, heterogeneous strong Qinshui coalbed gas reservoirs, due to low permeability reservoir effective deflation range Limited, resulting in a single well production capacity is low, to form a certain scale or to achieve a certain speed of development, Must be greater than conventional gas reservoirs. In addition, due to the pressure drop between coalbed methane wells is conducive to the use of reserves and improve Recovery rate, and therefore also lead to coalbed methane development well pattern density, well spacing is small; reasonable coalbed methane production wells From both to ensure that the development period

of development area of high recovery rate, but also to ensure a certain economic benefits, that is to ensure the best Single well production capacity.

1) Interwell interference

Coalbed methane mining requires the overall drainage of the block, and the interwell interference can quickly reduce the formation pressure, So that more gas desorbed. In the case of multiple wells, the discharge area of the adjacent wells is overlapped and formed superimposed pressure drop funnel. The superimposed pressure drop funnel can cause the pressure in the middle of the two wells to drop quickly to critical desorption Pressure below, so as to maximize the final recovery. Therefore, the coalbed methane wells are the key to how to study Optimize the type of well pattern, well spacing and well pattern density, in order to achieve the purpose of maximizing the interference between the wells.

2) Reasonable well pattern can increase coalbed methane production

Coalbed methane can be used in the type of well pattern is generally a rectangular well pattern and diamond well pattern. Different types of well patterns are generated the degree of interference between the wells is not the same. The rectangular well pattern is required to be perpendicular to the main infiltration and perpendicular to the main infiltration well, and the adjacent four wells are rectangular. The well pattern is more convenient to arrange, suitable for penetration in the main drawback is that the center of the four wells of the buck rate is smaller, the desorption effect of coalbed methane in the area is poor. The rhombus well pattern requires two directions along the main infiltration direction and perpendicular to the main infiltration To the vertical wells, in the center of the four wells, the encryption of a coalbed methane development wells, so that the adjacent four wells Was a diamond-shaped, mainly for a rectangular well pattern of a supplement or perfect form. Its advantage is when draining, well and the pressure between the wells is relatively uniform.

3) The best well spacing

Well spacing is an important indicator of coalbed methane wells. Coalbed methane development without injection wells, and well spacing options There is a direct impact on the interwell interference: well spacing is too large, the pressure between the two wells is not superimposed, the equivalent of a single well in the row Mining; well distance is too small, although the buck effect is good, but too many wells will make the block development costs. therefore, The determination of the optimum well spacing is critical. The best well spacing is coalbed, adsorption, development, and development Office, drilling costs, mining costs of the integrated function, more difficult to determine.

#### **4. CONCLUSION**

(1) CBM development program adhere to the principle of low cost, high efficiency, to determine the effective development methods, well pattern deployment design.

(2) For special coal seams, coal seams, such as those with a thin thickness, a developmental dispersion or a strong change in thickness and shape, are not suitable for horizontal wells.

(3) Reasonable coalbed methane production wellbore not only to ensure the development period of development area of high recovery rate, but also to ensure a certain economic benefits, that is to ensure the best single well production capacity.

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