Study on Economic Evaluation of Long-term Planning for Tight Gas Exploration and Development in Sichuan Basin

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Abstract. The development of tight gas projects in the Sichuan Basin has come into prominence, and a good economic evaluation of tight gas exploration and development planning plays a very important role in realizing the long-term development goals of oilfield enterprises and ensuring the sustainable development of enterprises. The article analyzes the economic evaluation method of long-term planning for oil and gas exploration and development, elaborates the calculation process of cash flow, and discusses and analyzes the possible problems of long-term planning for the exploration and development of tight gas in the Sichuan Basin according to the characteristics of the exploration and development of tight gas in the Sichuan Basin at the present stage, in order to achieve the purpose of supporting the medium- and long-term investment decision of tight gas in the Sichuan Basin more accurately and efficiently, and it has important practical significance for assisting the rapid production and high-quality development of tight gas in the Sichuan Basin.

Keywords: Sichuan Basin, Tight Gas Exploration and Development, Long-Term Planning, Economic Evaluation.

1 Introduction

In recent years, the development of tight gas projects in the Sichuan Basin of Southwest Oil & Gas Field (SWOGF) has come to the forefront. in 2022, SWOGF's tight gas production will reach 2.5 billion cubic meters, accounting for about 6.6% of its total natural gas production. The next step of tight gas development of Southwest Oil & Gas Field will be to move towards scale efficiency, focusing on the formation of a series of tight gas exploration and development technologies adapted to the Sichuan Basin and exploring the path to further reduce the cost of exploration and development, which will play an important role in improving China's self-sufficiency in natural gas, guaranteeing the country's energy security, and contributing to the "dual-carbon" goal[1].

Oil and gas exploration and development planning includes the process of planning long-term goals and formulating implementation plans for petroleum enterprises, and

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is a programmatic document that guides the direction and scale of investment. Therefore, the advantages and disadvantages of the planning program not only affect the economic benefits and the balance of inputs and outputs during the planning period, but also affect the long-term economic benefits of the oil enterprises after the planning period. long-term planning for oil and gas exploration and development generally refers to the development plan for a period of 5 to 10 years, focusing on and doing a good job in the economic evaluation of tight gas development planning in the Sichuan Basin is of great significance to promote the scientific process of development decision-making in the Southwest Oil and Gas Field Company, to realize its long-term development goals, and to ensure its sustainable development.

2 Evaluation methodology

2.1 The "with or without comparison" principle

The principle of "comparison with or without" is the basic principle of benefit evaluation for long-term planning of oil and gas exploration and development, and "comparison with or without" refers to the identification of incremental inputs and benefits of the project to be evaluated by comparing the differences in the obtainable quantities of inputs and outputs of the project in the two cases of "project with" and "project without", Comparison of "with or without project" refers to the identification of incremental inputs and benefits of a project by comparing the differences in the obtainable quantities of inputs and outputs of the project to be evaluated under the "with project" and "without project" scenarios[2].

The difference between the "with project" data and the "without project" data in the calculation period is the incremental benefit of the project to be evaluated, and the "with or without comparison" excludes the influence of various conditions before the project to be evaluated is implemented according to the new program design, and emphasizes the importance of the project. The "with or without" comparison excludes the effects of the conditions that preceded the implementation of the project under the new programmatic design and highlights the effects of the project's new activities. The scope and period of calculation of benefits and costs in the "with project" and "without project" scenarios should be consistent and comparable.

2.2 Cash flow calculation and analysis

The evaluation process of discounted cash flow method is to collect the program design and all kinds of basic data of geological gas reservoir project, drilling project and surface project, and then estimate the investment, cost, income and all kinds of taxes and fees on a yearly basis, so as to form the cash inflow and outflow on a yearly basis, and then calculate the difference between the cash inflow and outflow to form the net cash flow on a yearly basis[3].

Cash inflow. The calculation of cash inflow is mainly based on the production plan of geological gas reservoir engineering design in the program of development planning and the forecast of future sales price of the products, which mainly includes the calculation of sales revenue of the products, the residual value of fixed assets recovered at the end of the period and the working capital.

Cash outflow. The calculation of cash outflow is mainly based on the drilling and production plan of the geological reservoir engineering design in the development plan, as well as the various process engineering parameters and workload arrangements of the drilling engineering, gas production engineering and surface engineering design. The calculation mainly includes investment estimation, total cost estimation, business tax and surcharge.

Net cash flow. The algebraic sum of cash inflow and cash outflow in a certain period is called net cash flow.

Financial analysis. On the basis of the calculation of cash flow indicators, further calculate the internal rate of return, financial net present value, payback period, unit full cost and other economic evaluation indicators, analyze and evaluate the project's profitability, reimbursement ability and financial viability, judge the project's financial acceptability, and clarify the project's contribution to the value of the Group Company.

3 Issues requiring attention

3.1 Natural gas commodity rate and gas prices

It is not appropriate to set a fixed ratio for the natural gas commodity rate in the long-term planning program. For projects with low self-consumption of natural gas, it is necessary to reflect the goal of continuously improving the commodity rate of the project due to technological and management progress, optimization of gathering and transmission, energy saving and consumption reduction; for projects with high self-consumption of natural gas, it is necessary to reflect the trend of decreasing commodity rate caused by decreasing of raw material gas and increasing of compressor power in the later stage of the project[4].

The long-term price of condensate and stabilized light hydrocarbons can refer to the long-term oil price forecast in the economic evaluation parameters of the group company and make appropriate adjustments according to the actual situation of the project; the price of LNG, CNG and LPG should be priced in the market. In the economic evaluation of the long-term planning program, for products with large fluctuations in market prices, the project capacity should be combined with the supply and demand situation in the market, and a reasonable market price should be researched and predicted.

3.2 long-term prices of ancillary products

The long-term price of condensate and stabilized light hydrocarbons can refer to the long-term oil price forecast in the economic evaluation parameters of the group company and make appropriate adjustments according to the actual situation of the project; the price of LNG, CNG and LPG should be priced in the market. In the economic evaluation of the long-term planning program, for products with large fluctuations in market prices, the project capacity should be combined with the supply and demand situation in the market, and a reasonable market price should be researched and predicted.

3.3 Investment estimation

Investment estimation should reflect technological progress. In the oil and gas industry, oil and gas drilling engineering occupies an important position. Oil and gas drilling project investment accounts for 60%-70% of the investment in oil and gas exploration and development projects, tight gas wells in the Sichuan Basin have long horizontal sections, large-scale fracturing and other characteristics that make their drilling investment accounted for a greater proportion of the total investment in the project. The long-term planning project of tight gas exploration and development should strive to reduce drilling investment in phases by optimizing well structure, optimizing drilling technology, fine field management, optimizing fracturing plan and fracturing construction technology[5].

Investment estimation should reflect the scale effect. With the acceleration of tight gas exploration and development in the Sichuan Basin, the investment estimation needs to take into account the influence of scale effect, and make use of large platforms, factory operation, optimization of ground gathering and transportation process and other methods to reduce the investment in average drilling and ground engineering in stages[6].

Investment estimation should pay attention to digital transformation and "dual-carbon" goals. Drilling engineering and ground engineering automation, digitalization, intelligence is the inevitable trend of future industry development, is to crack the manpower shortage, labor inefficiency and other structural contradictions of an effective means, and "double carbon" goals complement each other. We are practicing a new model of green and environmentally friendly development, and continue to promote the popularization and application of electricity instead of oil and gas instead of oil in drilling and ground equipment. We will intervene in the economic evaluation of long-term exploration and development planning programs in advance, and consider the contribution of carbon emission reduction when participating in the selection of equipment and the comparison of gathering and transportation programs.

3.4 Cost estimation

The estimation of operation cost shall be in line with the method of gas field exploration and development and the development law. The estimation of unit operation cost

should be in line with the law of gas field exploration and development, with the production period decreasing with the development process, the stable production period reaching the lowest and maintaining for a period of time, and the decreasing period gradually increasing. Tight gas project in Sichuan Basin contains a variety of products such as LNG, CNG, etc., and the processing cost of these products should also be considered, especially the higher processing cost of LNG, which is generally above 1000 RMB/t at this stage and cannot be ignored.

Choose reasonable depreciation method. Tight gas in the Sichuan Basin has the characteristics of rapidly decreasing production, the traditional straight-line method of depreciation can not reflect the principle of "income and expense ratio", the use of the production method of depreciation can better realize the proportion of costs and benefits, so that the depreciation trend and the production trend as far as possible to match. When using the production method to calculate depreciation, we should also learn from the treatment of straight-line depreciation, calculate the depreciation of the annual investment in the following years according to the depreciation rate of standard wells, and then add up the depreciation formed by all the investments as the depreciation of the gas field, and calculate the depreciation on the basis of the original value of the assets instead of the net value of the assets, so as to ensure the accuracy of the calculation.

3.5 Financial analysis

Focus on multi-program selection. long-term planning program involves natural gas supply and demand and industry chain planning to the construction and operation of the overall coordinated development of the problem, by the overall exploration and development of the difficulty of increasing market development is not expected to be unknown and other factors, exploration and production and supporting the deployment of the construction of conflict is very likely to occur. The coordination of natural gas pipeline network construction and operation also needs to be improved. For these reasons, the tight gas exploration and development planning program in the Sichuan Basin should not only compare the design of different construction scale programs, but also to the same scale, in order to adapt to the development of the industry chain or pipeline network construction planning caused by different construction and production speeds, different product marketing programs than the selection[7].

Focus on risk analysis. Tight gas exploration and development of long-term planning as a petroleum enterprise in the future for a long time production implementation plan, investment direction and investment scale of the guiding, programmatic documents, it is all the more important to tie up the Group's risk assessment guidelines to strengthen the investment risk assessment and analysis work. Investment risk is a collective term for the risk factors and overall risks faced by investment projects that affect the realization of their objectives. Risk evaluation should be based on the results of risk identification and risk estimation, based on the project risk identification criteria, to find out the key risk factors affecting the success or failure of the project. The criteria for evaluating the magnitude of project risks should be based on the likelihood of the occurrence of the risk factors and the losses they cause.

4 Conclusion

The economic evaluation of medium and long-term planning for tight gas exploration and development in Sichuan Basin should be based on the theoretical system of economic evaluation of oil and gas field exploration and development projects, combined with the actual situation of the tight gas project in Sichuan Basin to achieve a reasonable prediction of the product price and commodity volume, based on the technological progress and the scale effect and combined with the green development mode of investment estimation, selecting the costing method and depreciation method in line with the actual situation of the project, and focusing on the multi-scheme comparison and risk analysis. Only by choosing the costing method and depreciation method in line with the actual situation of the project, focusing on multiple options and risk analysis can the future benefits of the project be estimated more accurately and production decision-making be helped. The article has certain innovation and practical significance in the theory of medium- and long-term planning for tight gas exploration and development in Sichuan Basin, but there are still many deficiencies in the selection of evaluation benchmark indicators and adjustment of phasing method, which need to be further improved in future practice and research.

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