Study on benefit evaluation of developed oil and gas fields

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Abstract. With the development of economy and the fluctuation of international crude oil price, people are more and more concerned about the economic benefits of oilfield development. At present, most of the domestic oil fields have entered the middle and late stage of development. With the increase of water cut and decline of production, the economic benefits vary greatly, and some single Wells and block incomes are not enough to make up for their production costs. How to carry out economic evaluation, provide basis for production and operation decision, and seek the best economic benefit is the first problem that must be studied and solved in the development of oilfield quality benefit. Single well and block benefit evaluation system is applied in this article, combined with the most oil field in recent years, the crude oil output, production cost, sales income, etc. comprehensive analysis and evaluation has been developed single well, block, formulate corresponding measures and countermeasures, to guide the oilfield production and operation, inefficient, invalid next block and single well comprehensive treatment has a positive meaning.

Keywords: Economic evaluation; Classification standard; Cost Structure single well block.

1. Introduction
1997 southeast Asian financial turmoil caused by the Asian economic crisis has caused international oil market oversupply situation, leading to a fall in the price of crude oil has greatly, which has lower than international market prices of domestic crude oil prices higher than international prices, the difference between the huge profits made smuggling oil poured in, disturb the normal order of production and sales of domestic oil. Since June 1, 1998, domestic crude oil prices have been in line with international standards, making oil companies face international competition directly. In 2003, based on the single well benefit evaluation software of Liaohe oilfield, the oil-gas field benefit evaluation system of joint-stock company was developed. Then the oil and gas field benefit evaluation system has added the functions of benefit distribution and investment evaluation, and is still in use today.

2. Objective and criterion of benefit evaluation
The purpose of benefit evaluation is to grasp the production and operation status of oil and gas fields timely, maintain oil and gas production, make investment decisions, and provide basis for cost control and business development planning. The method is to judge the operating status of oil Wells by the sales revenue, cost and expenses, taxes and other indicators. On the basis of benefit analysis and cost analysis,
the benefit types of oilfield are divided into benefit well, marginal benefit well and non-benefit well with the boundary of operation cost and minimum operating cost. At the same time, considering the degree of contribution of oil field to the enterprise, and taking the comprehensive cost, production cost and operation cost as the boundary, the benefit well is further divided into benefit well type I, benefit well type II and benefit well type III. The block benefit evaluation standard is similar to the single well benefit evaluation except that the block whose after-tax income is less than the operating cost is classified as the block with no benefit.

| Standard for classification of single well benefit | Standard of block benefit classification |
|-----------------------------------------------|--------------------------------------|
| Benefit categories                             | Classification standard              |
| benefit well type I                             | After-tax income > The cost of production + The management fee + Exploration cost |
| benefit well type II                            | The cost of production + Exploration cost ≥ After-tax income > The cost of production |
| benefit well type III                           | The cost of production ≥ After-tax income > Operating costs |
| marginal benefit well                           | Operating costs ≥ After-tax income > Minimum operating cost |
| benefit well                                   | After-tax income ≤ Minimum operating cost |

3. Cost structure and its interrelation

The so-called benefit evaluation is the evaluation of well and its cost relation. The first is the well requirements. Evaluation can only be conducted when the well meets one of the following conditions: A production time is greater than zero; B operation cost is greater than zero; C wellhead fluid production is greater than zero; D verification of oil production is greater than zero; In order to facilitate the economic evaluation and analysis of reservoir, evaluation units are divided according to the development characteristics, production scale, classification of oil products and other factors of the block. Then, the sources of various costs and expenses are given. Finally, the evaluation results of related single Wells and blocks are obtained by using the single-well benefit evaluation software. Below, we emphatically introduce the composition of various costs and expenses and their correlation.

(1) Direct material cost: it can be directly accounted into the direct cost of a single well. For the material consumed by the station and the operation area authorities that cannot be directly accounted into the cost, it shall be apportioned according to the following methods.

Direct material cost per well = material cost/total number of days of well opening × the number of days of well opening

(2) Direct fuel cost: including crude oil, natural gas, gasoline, diesel oil and coal used by the well station. Natural gas, including natural gas produced for its own use or transferred for supply, shall be apportioned according to the amount of liquid produced.

Direct fuel cost per well = fuel cost/total liquid production of each well × liquid production of a well

(3) Direct power cost: The electricity cost incurred by a single well shall be directly included into the cost of a single well according to its daily meter reading or calculated consumption, and the power cost consumed by the oil production station and the operation area authorities shall be apportioned according to the following methods.

Direct power cost per well = electricity charge/total liquid production of each well × liquid production of a well
Table 2. Table of Cost-benefit Relationship

| Cost classification | Operating costs | Comprehensive cost of production | Management fees + Exploration cost + Finance charges + Cost of sales + Other fees |
|---------------------|-----------------|----------------------------------|---------------------------------------------------------------------------------|
| Cost                | Minimum operating fee | The cost of the project           | Depletion of depreciation                                                       |
| Direct cost of materials | Heavy oil thermal recovery | Dividing the cost items according to the operation process | Maintenance and repair |
| Direct fuel charge | Oil and gas treatment fee | Direct cost of materials | Gas purification fee |
| Direct power cost | Light hydrocarbon recovery charges | Direct personnel costs | Transportation costs |
| Direct personnel costs | Gas purification fee | Flooding charge | Logging test fee |
| Downhole operating expenses | Maintenance and repair | Downhole operating expenses | Factory management fee |
| Factory management fee | Factory management cost | Management fees | Other direct expenses |

(4) Direct personnel expenses: including salary, extraction of worker welfare funds, union funds, employee education funds, basic endowment insurance, industrial injury insurance, birth insurance, unemployment insurance, and other internal labor insurance, endowment insurance to plan as a whole project cost, from retiree health care, housing accumulation fund, market-oriented employment cost, overtime meal allowance, etc.

Direct personnel cost per well = personnel cost/total number of days in operation of each well × number of days in operation of a well

(5) Other direct costs: direct fuel costs, direct materials costs, electricity costs and personnel costs that cannot be directly included shall be apportioned according to the oil produced.

Other direct costs per well = total other costs/total oil produced by each well × oil produced by a well

(6) Displacement injection cost: refers to the cost of materials, fuel, power, personnel, maintenance and repair, etc. incurred during the operation of water injection, gas injection or chemical injection into oil and gas reservoirs for the purpose of enhancing oil recovery. The cost of water injection post, sewage reinjection post and water injection station in the gathering and transportation brigade is calculated here.

(7) Downhole operating expenses: refer to the expenses incurred in the operation of oil and water Wells to improve their production capacity and maintain their normal production, including the costs of outsourced downhole technical measures, maintenance costs, materials and other related expenses incurred during the operation. The beneficiaries of downhole operations are clear and, in principle, there will be no shared costs.

(8) Maintenance and repair "means to maintain the normal operation of the oil and gas production, ensure the ground facilities, equipment, the existing production capacity, on the ground facilities maintenance fee, kits, including buildings and repair, oil and gas Wells, metering station, station, pattern lines, motors, pumping unit, distribution circuit, heating facilities, etc. If it can be directly included in a single well, part of the difference between the production station and the carry-over engineering unit will be apportioned according to the number of days the well is opened.

Maintenance and repair cost = total maintenance and repair cost/total opening days of each well × the opening days of a well

(9) Heavy oil thermal recovery costs: refer to the costs of steam production, steam injection and heat preservation incurred in the process of heavy oil recovery by steam stimulation, steam flooding or other thermal recovery methods. The cost and revenue of steam injection, air injection, external relocation, heat injection are calculated here.
(10) Oil and gas treatment fee: refers to the expenses incurred in the separation and treatment of oil, gas, water and other mixtures during oil and gas production. Specifically, it refers to the direct material costs, direct fuel costs, direct power costs, direct personnel costs, repair costs and transportation costs incurred in the joint stations, sewage stations and other sites of oil and gas treatment installations. The costs of mixing oil and water in each oil production area and the costs of gathering and transportation brigade other than flooding are calculated here, and the costs are apportioned according to the actual liquid production.

(11) Transportation costs: refer to all transportation costs incurred in providing transportation services for oil and gas production, including external and internal freight. The partial difference of freight cost and carry-over transportation brigade and comprehensive fleet of oil production stations in each oil production area shall be calculated herein. If it can be directly included in single well, it shall be directly included; if not, it shall be apportioned according to the production.

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\text{Transport cost per well} = \frac{\text{total freight}}{\text{total oil production of each well}} \times \text{oil production of a well}
\]

(12) Factory management fee: refers to the expenses incurred by the oil production plant and the production management departments at two levels of the operation area directly engaged in oil and gas production to organize and manage production. The costs incurred by the authorities of each oil recovery operation area, factory authorities, geological institute (except the well testing team), are calculated here and apportioned according to the output.

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\text{Management fee per well} = \frac{\text{total management fee per well}}{\text{total oil production of each well}} \times \text{oil production of a well}
\]

(13) Logging test fee: refers to the monitoring fee incurred in the process of oil and gas production in order to grasp the distribution dynamics of oil, gas and water underground. Geological monitoring fees and well testing team costs are calculated here.

Self-used oil and gas cost: refers to the cost of self-produced oil and gas products consumed in the process of oil and gas production.

(14) Depreciation: Depreciation and depreciation is to compensate for the value loss of oil and gas assets and fixed assets other than oil and gas assets in the production process. The value of oil and gas assets and fixed assets is included in the cost in the form of depreciation and depreciation, and the depreciation is calculated by the production method.

4. Application of benefit evaluation results

Through the analysis of the benefit evaluation results, we can clearly grasp each block, each well the actual circumstances of the input and output, the operating cost of main control factors and the causes of high cost block, inefficient Wells management direction and decision science for policy makers, geological technology department of scientific evaluation and demonstration, scientific management has played an important role in oil Wells.

According to the evaluation results, the material cost, downhole operation cost, maintenance and repair cost of the direct operation cost of controlling the single well in advance for the single well with higher direct operation cost. Each department should precontrol the input of this type of well when arranging the production plan, and try to reduce the input as much as possible compared with the low input-output oil and gas well, and put the limited capital into the single well with good benefit. For oil Wells with low efficiency and inefficiency caused by short repair exemption period and high workover and maintenance costs, we should give full play to the role of science and technology in oil well management, dig deep management potential, and adopt supporting measures one well at a time to extend the repair exemption period. For the renewal of new and old tuberod pumps, corresponding replacement schemes should be formulated for different single Wells to maximize the extension of the service life of tuberod pumps, optimize the design of schemes, reduce the occurrence of repeated pump inspection Wells, and reduce maintenance operating costs. For the single well with no obvious effect of cost control and production and potential tapping, the production situation of interpumping is changed according to the actual situation while the cost is controlled to the maximum, and the benefit after the change is finally monitored.
According to the evaluation results, the following measures are mainly adopted to improve the low efficiency well area caused by different reasons.(1) the authors and a reservoir of stripper well through the review, looking for a replacement layer, implementation layer between succeed, improve the utilization efficiency of the well b for the enrichment of remaining oil distribution, well pattern, formation energy relative abundance, and low single well productivity of oil well, adopting fracturing, detonation pressure, large reservoir renovation measures such as acidification, digging Wells to potential c shut down low pow, reduce invalid input d, optimize production way, inefficient Wells, low pressure well, middle well location and remote management difficult Wells, the implementation of smoking or between bailing production, achieve low single well efficiency e reasonable adjustment well pattern, injection effectively f, relying on technological process reengineering. Reduce operating costs of well stations (2) repair and waste, save operating costs (3) asset write-off, strengthen the write-off of invalid assets, reduce depreciation and depreciation, and achieve economic production.

5. Conclusion
The task of oil and gas field benefit evaluation is to conduct economic evaluation on oil Wells and blocks to determine which Wells and blocks are profitable and which Wells and blocks are not. Through economic evaluation, the economic output of oil Wells and blocks can be determined, low-benefit Wells can be improved, investment direction can be optimized, and enterprise benefit can be maximized. At present, most of the domestic oil fields have entered the middle and late stage of development. With the increase of water cut and decline of production, the difference of economic benefits is very big. Some single well and block income is not enough to make up for the production cost. Therefore, we apply the benefit evaluation system to comprehensively analyze and evaluate the benefit status of the developed single well and block in combination with the crude oil output, production cost and sales revenue in recent years, and formulate effective treatment measures and countermeasures to improve the development benefit status and promote the sustainable development of the oilfield.

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