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# CHARACTERISTICS OF OIL AND GAS EXPLORATION AND DEVELOPMENT COSTS OIL AND GAS FIELDS

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**ABSTRACT**

*The article shows the main aspects of the formation and development of the characteristics of oil and gas exploration and development costs oil and gas fields. Such concepts as completeness of oil recovery increase in oil and gas reserves and depth of oil and gas processing are considered. Evaluation of geological and economic efficiency of geological exploration and fundamentals of accounting for oil and gas producing enterprises are presented.*

**KEYWORDS:** *Oil and Gas, Costs, Geological Exploration, Development Costs.*

## INTRODUCTION

Oil and natural gas are among the main minerals that have been used by humans since ancient times. Oil is a specific commodity, a monoproduct, which differs in its qualitative characteristics. In fact, there is only one area of oil use – oil refining. Oil refining products-gasoline, diesel fuel, kerosene, fuel oil, lubricants, coke, paraffinfor example, bitumen is used in many sectors of the economy, the most massive of which are transport and energy. A number of products obtained from petroleum products are irreplaceable (lubricating oils, bitumen, paraffin).

Natural gas has economic advantages over other energy carriers. First, due to the presence of significant reserves and the relative cheapness of its extraction and transportation. Second, the conversion of natural gas into chemical products requires lower costs compared to the use of petroleum raw materials, not to mention coal [1].

***Main body.*** In the field of exploration, production and refining, the state is interested in developing the oil industry in the following main areas:

1) *Completeness of oil recovery*. An oil field has its own life cycle, in the last stage of which there is a significant flooding of the extracted products, respectively, the costs of oil extraction and treatment increase. The company's interest lies in the fact that the field is fully developed, and at the time of well completion, there should be no oil left in the subsurface that could still be extracted. The interest of oil producing companies is in the most efficient development of the field. Efficiency in this case means getting the maximum level of return (profit) from development deposits. If we assume that the company cannot determine oil prices, it still has cost management at its disposal. At the last stage of the well's life, costs may increase to a level higher than the selling price. In this case, it would be more rational to eliminate the wells until the reserves are fully recovered. The state has two tools at its disposal to influence companies to comply with their interests-taxation and direct coercion: the tax rate on mineral extraction currently does not depend on the stage of the well's life cycle» this does not contribute to the convergence of the interests of private capital and the state; production volumes are determined in the license agreement for oil production. Failure to comply with the license terms is a reason for revocation of the license.

2) *Increase in oil and gas reserves*. Replenishment of reserves (exploration) and preparation of reserves for extraction are vital for the continuation of the activities of both the government and private companies.

For the state replenishment reserves has value, as from the side strategic security, as well as with parties to ’tax authorities' receipts (income tax mining useful ones mineral resources, export operations duties, income tax). The ability to replenish the prepared reserves determines the company's ability to continue its operations in the long term. The simplest criterion for sustainability can be the increase in reserves based on the results of the reporting period: the increase should be at least as high as production for the period. The interests of the state and firms in this case coincide. In relation to geological exploration, the fiscal and authoritarian tools of the state work as follows [2]:

- Exploration costs are deductible for the purposes of calculating income tax;

- The scope and content of exploration activities that are required to be carried out is fixed in the license agreement for a specific site;

- based on this, we can characterize the current situation as managed by the state, and the lack of incentives is explained by the initial interest of firms in increasing the resource base.

3) *Depth of oil and gas processing*. The depth of processing is determined by the amount of products that can be obtained from 1 ton of oil or 1 $m^3$ gas supply. The state's interest in increasing the depth of refining is based on the resource-saving side of the problem: if we assume that the demand for gasoline, for example, is known in advance, then this demand can be met with as little oil as possible if it is processed more fully. However, the construction of plants that increase the degree of processing requires significant capital investments.

**Geological exploration works**

***Geological exploration activities work*** (more – GEW) they are conducted for the purpose of identifying oil-bearing subsurface areas, detailing data for exploration and production drilling, calculating and clarifying reserves.

Results of the event GEW data on oil reserves, as well as information related to determining the most efficient well placement and production method, are considered (if they are effective). Thus, GEW for the most part are future expenses.

In in accordance with the Temporary Regulations on the stages and stages of geological exploration for oil and gas, depending on the tasks they face, the state of exploration of the oil and gas potential of the subsurface is divided into on:

Regional;

Search and evaluation center;

Exploration site.

The main purpose of *regional* geological and geophysical research is to study the main regularities of the geological structure of poorly studied sedimentary basins and their sections and individual litho logical and stratigraphic complexes, assess the prospects for their oil and gas potential, and identify priority areas and litho logical and stratigraphic complexes for setting up oil and gas exploration operations at specific sites.

The regional stage of subsurface exploration precedes the search and evaluation stage and is carried out as long as there are favorable prerequisites for the discovery of new promising complexes at undeveloped depths and oil and gas accumulation zones in poorly studied areas. Within oil and gas bearing areas, regional operations can be carried out simultaneously with prospecting, evaluation and exploration activities.

Goal of *search and evaluation works*is the discovery of new oil and gas fields or new deposits in previously discovered fields and the assessment of their reserves in the sum of categories $C_1$ and $C_2$. The search and evaluation stage is divided into the stages of identifying search drilling objects, preparing objects for search drilling, and searching and evaluating deposits.

Goal exploration stage is learning characteristics of deposits (deposits) that provide drawing up technological scheme of development (project pilot operation oil field (deposits) or a project for

pilot operation of a gas field (deposits), as well as clarification of field characteristics operational facilities in progress development projects. The objects of work are oil and gas fields (deposits).

**Evaluation of geological and economic efficiency of geological exploration**

Evaluation of geological and economic efficiency is based on indicators that characterize the results of exploration [3]:

Number of wells drilled or projected;

Increase in reserves of categories $C_1$, $C_2$, t;

Exploration drilling volume, m;

Search costs, mln. rub.

The volume of exploration drilling is the total square footage of all drilled or projected exploration wells in a field (deposit).

Inventory growth is taken as actual or projected.

Search costs they include the costs of all types of geological exploration: preparation of structures for drilling, drilling costs, and other activities. Drilling costs include the total cost of well construction based on a consolidated financial estimate. The costs of preparing the structure for exploratory drilling and the amount of geophysical work performed are determined based on the data of geophysical reports on the preparation of the object.

Specific indicators of geological and economic efficiency are calculated based on general exploration indicators:

Reserves growth per 1 m of sinking, tn / m;

Increase in reserves per 1 well, tn/sq.m.;

Inventory growth by 1 thousand rubles of costs, tn /1000 rubles. ;

Preparation costs for 1 ton of reserves, RUB / ton.

Increase in reserves per 1 m of penetration (Ir/m) is determined by by dividing the increase in reserves by drilling volume ($Q_m$):

$Ir/m = Q_r/Q_m$

where$Q_r$– expected increase in recoverable reserves of the category $C_1 + C_2$.

Increase in reserves per 1 well (Ir/well) defined by by dividing the increase in reserves by the number of drilled wells.

$Ir/well = Q_r/n$

where – number of projected exploration wells.

Inventory growth per 1,000 rubles of expenses (Ir/1000 rub) defined by dividing the increase in inventory by the amount of exploration costs:

$Ir/1000\ rubles = Q_r/C$

Where C – is the cost of search operations.

Preparation costs of 1 ton of increment (Ct) reserves are determined by dividing the total cost of search and development-exploration activities works performed in thousands of rubles by the amount of received data stocks in tons.:

$Ct = S/Q_r$.

Cost of one meter of drilling (Cm) defined by dividing the amount of exploration drilling costs by volume penetrations ($Q_m$):

$Cm = S/Q_m$.

**Oil and gas field development costs**

The development and operation of oil and gas fields includes a scientifically based production process for extracting hydrocarbons and related minerals from the subsurface, the process of designing systems for developing oil and gas deposits, the mutual location of the bottom holes of production, injection, reserve and other wells, drilling the field in accordance with approved technological documentation, and the development of oil and gas reserves [4].

Development it should meet the needs for oil and gas at the lowest cost and while achieving the maximum possible oil recovery, and depending on specific geological and physical features, it can be carried out either under natural conditions or with an impact on productive formations [5].

Regulation developments depends on the relative location of production and injection wells, the distance between them (drilling density), the volume of injected water and liquid extraction in production wells. Monitoring for development It is implemented by various research projects in in wells and on the surface, appropriate adjustments are made if necessary. Project development payment is made on the basis of multivariate options economic calculations.

**Fundamentals of accounting for oil and gas producing enterprises**

One of the most common methods of accounting for oil and gas producing enterprises in the world practice is accounting in accordance with generally accepted accounting principles (US GAAP) [6]. The main document is Regulation No. 19 "Financial accounting and reporting by oil and Gas Producing enterprises"(hereinafter-IAS 19). Currently, two accounting methods are common:

- Effective cost method (Successful efforts method);

- Full cost method (Full cost method).

The effective cost method is more often used by large companies, and the full cost method, respectively, is mainly the choice of medium-sized companies due to the greater simplicity of accounting.

Here are the main principles of accounting using the effective cost method in comparison with the full cost method. The main cost elements are:

- Acquisition of rights to subsurface areas (acquisition costs);

- Exploration (exploration costs);

- Preparation (development costs);

- mining (production costs).

According to with IAS 19 rights to subsurface areas include ownership as an owner or lessee, a concession or other rights to produce oil or gas under the terms stipulated in the transfer of the relevant right. Rights to subsurface areas include in as well as royalties and payments operational level natural resources carried out in the form of oil or gas, and other participation rights in subsurface areas used by others by companies, not directly entitled to land plot operation subsurface resources. Rights to subsurface areas include the following: agreements with by foreign governments or authorities, in in accordance with the which the company participates in the operation of appropriate ones land plots or otherwise acts as an enterprise that is assigned the function of managing the development of mineral resources. to extract overlying areas inventory levels.

The cost of acquiring rights to subsurface areas is capitalized in time of occurrence, outside of depending on, are located they have proven reserves or no. Data costs include:

- Purchase of licenses.

- Related legal costs (commission to brokers. lawyers, transaction costs).

- Internal department costs.

- Other acquisition costs.

Costs incurred after the acquisition (for example, lease payments and taxes) should be written off for the current period.

In accordance with the full cost method, both costs incurred at the time of origination and expenses incurred at the time of origination are subject to capitalization. and subsequent costs associated with subsurface areas.

*Costs of geological exploration*. In accordance with the effective cost method under US GAAP, exploration activities are divided into "drilling-related" and "non-drilling" exploration wells and exploration-type stratigraphic wells. The costs of geological exploration and geophysical work (not related to drilling), maintenance and conservation of untreated subsurface areas should be written off as expenses of the current period at the time of occurrence, with the exception of certain seismic surveys (ZD and 4D), which are carried out in areas with proven reserves in order to determine the points of operational risk. drilling operations and specifying field boundaries.

*Costs of drilling exploration wells and stratigraphic wells of exploration type* should be capitalized together with uncompleted wells and equipment and structures prior to receiving confirmations that were made in whether or not proven reserves have been discovered as a result of drilling such wells. If proven reserves have been identified, the capitalized cost of drilling the well should be part of the cost of items such as wells, ancillary equipment, and facilities businesses (even if by default after drilling, the well is not translated part of the operating system if the well has not found any proven losses due to the cost of drilling the well, less its residual value (if any), is capitalized.) they are written off as expenses for the current period.

According to the full cost of capitalization method subject to all costs exploration expenses, both related to exploration drilling and non-related:

- Geological exploration activities works

- Geophysical research

- Acquisition of geological and geophysical information from third parties

- Exploration wells and exploration-type stratigraphic wells

- Dry wells

***Preparation costs.*** In the extractive industry, development usually refers to activities related to the construction and preparation of extractive production facilities and infrastructure for operation. In accordance with the effective cost method under US GAAP, the cost of preparing subsurface areas should be capitalized as part of the cost of wells and related equipment and facilities. Therefore, all costs of drilling and constructing production wells, stratigraphic production wells, and maintenance wells are preparation costs and are capitalized independently. depends on whether the well is productive or not. Cost of acquisition or construction of auxiliary equipment and structures used in oil production activities, also it must be capitalized. Examples of auxiliary equipment and structures include seismic, drilling, construction and earthmoving equipment, machinery, repair shops, warehouses, and supply departments, camps and administrative offices. In terms of development costs, full-cost accounting is fully consistent with using the method effective costs.

***Production costs***. In accordance c using the method Using the US GAAP full cost method, it is generally assumed that the production phase of the project is determined by the effective cost method and the US GAAP full cost method, close in point of sale primary water tank outlet valve storage of extracted data raw materials. Production costs are the costs incurred for operation and well maintenance businesses, and also about equipment and structures, including depreciation and expenses for operation of auxiliary equipment and structures, as well as other costs for the operation and maintenance of such wells and related equipment and structures. Examples of production costs (sometimes referred to as extraction costs) are:

- Labor costs for operation wells, equipment buildings and structures;

- Repair and maintenance;

- Materials, raw materials, fuel and services used in the production of operating conditions wells and equipment and installations;

- Taxes on property and insurance expenses, related items to subsurface areas with proven reserves and wells, equipment and structures; depreciation.

Depreciation of the cost of acquiring subsurface areas, the cost of wells and related equipment is amortised using the unit of production method (flow method). The cost center for calculation can be either each subsurface area separately, or a reasonable consolidation of subsurface areas (field, basin) with a common geological structure or stratigraphic conditions [3].

*Formula for calculating depreciation of costs for the acquisition of subsurface areas* where proved reserves have been identified is as follows:

$$A = \frac{\text{Production}}{\text{PR}} \cdot AEA,$$

where: A – the amount of depreciation (write-off) of costs for the acquisition of subsurface areas with proven reserves; Production – the tonnage of oil produced during the reporting period (year, month); PR – proved reserves as of January, 1 of the reporting year; AEA –the amount of expenses for the acquisition of subsoil plots with proven reserves

*Formula for calculating the depreciation of drilling costs and the cost of related equipment* looks similarly, with the exception of used by inventory categories:

$$A = \frac{\text{Production}}{\text{PDR}} \cdot ACDA ,$$

where: A – amount of depreciation (write-off) of costs for development and arrangement of a subsurface area; Production – tonnage of oil produced during the reporting period (year, month); PDR – proved developed reserves as of January 1 of the reporting year; ACDA – amount of costs for development and arrangement of a subsurface area (with a deduction accumulated depreciation).

Subsurface areas with unproven reserves should be evaluated regularly in order to detect a decrease in their estimated value. The estimated value of a subsurface area is likely to decrease if, for example, a dry well has been drilled on it, and the company does not have firm plans to continue drilling. Also, the probability of a partial decrease in the value or complete depreciation of a subsurface area increases as the lease term approaches, if drilling has not been started on the subsurface area or on neighboring areas. If the results of the valuation showed a decrease in value, then the loss should be recognized by creating an estimate adjustment. Decrease the cost of subsurface areas with unproven reserves, the cost of acquiring each of which was sufficiently significant, should be determined separately for each subsurface area, and the loss should be shown by making an estimated correction. When an entity has a relatively large number of subsurface areas with unproven reserves and the cost of acquiring these areas separately is not significant, it may not be appropriate to assess the declared value separately for each subsurface area. In this case, the amount of the loss to be recorded and the amount of the estimated adjustments that need to be made to reflect a decrease in the value of subsurface areas will have to be determined by depreciation of such subsurface areas, either in aggregate or in groups, based on the company's experience in such situations and other information about factors such as the lease terms of such subsurface areas, the average lease term of subsurface areas with unproven reserves, as well as the relative share of those subsurface areas where proven reserves were discovered in the past [3].

When proven reserves are found in a subsurface area containing unproven reserves, the value of the corresponding subsurface area should be reclassified as a subsurface area with proven reserves. For subsurface areas for which a decrease in the estimated value has been determined, the residual value should be reclassified to the category of subsurface areas with proven reserves (with a deduction accumulated depreciation) [3].

Subsurface areas with unproven reserves should be evaluated regularly in order to detect a decrease in their estimated value. The estimated value of a subsurface area is likely to decrease if, for example, a dry well has been drilled on it, and the company does not have firm plans to continue drilling. Also, the probability of a partial decrease in the value or complete depreciation of a subsurface area increases as the lease term approaches, if drilling has not been started on the subsurface area or on neighboring areas.

## CONCLUSION

If the results of the valuation showed a decrease in value, then the loss should be recognized by creating an estimate adjustment. The decrease in the value of subsurface areas with unproven reserves, the acquisition costs of each of which were sufficiently significant, should be determined separately for each subsurface area, and the loss should be shown by making an estimated adjustment. When an entity has a relatively large number of subsurface areas with unproven reserves and the cost of acquiring these areas separately is not significant, then conducting an audit of the Company's operations should be considered. it may not be appropriate to estimate the declared value separately for each subsurface area. In this case, the amount of the loss to be accounted for and the amount of the estimated adjustment that must be made to reflect the decrease in the value of subsurface areas will have to be determined by amortizing such subsurface areas, either collectively or in groups, based on the company's experience in such situations and other information about factors such as the lease terms of such subsurface areas, the average lease term of subsurface areas with unproven reserves, and the relative share of those areas subsurface resources where proven reserves have been discovered in the past.

When proven reserves are found in a subsurface area containing unproven reserves, the value of the corresponding subsurface area should be reclassified as a subsurface area with proven reserves. For subsurface areas for which a decrease in the estimated value has been determined, the residual value (cost of acquisition, net of tax) should be reclassified to the category of subsurface areas with proven reserves. estimated value amendments); for subsurface areas that are amortized by making changes cost adjustment based on the total based on, the total cost of acquisition is subject to reclassification.

In in accordance with the full cost method, it must quarterly the so-called "Ceiling test" is performed», which it is intended to prevent exceeding the general terms and conditions. capitalized costs over the company's fair value. The main elements of the calculation include:

Capitalized costs less accumulated depreciation and deferred taxes,

Present discounted value (Present Value) future cash flows from production of proven reserves;

Costs excluded from the depreciation calculation base (unproven sections);

The lowest of the cost and fair value of unproven amortized land plots;

Deferred taxes (the difference between the accounting and tax value of capitalized costs for subsurface areas).

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