State Commission of Ukraine on mineral resources

TECHNICAL AND ECONOMIC FEASIBILITY OF CONDITIONS FOR CALCULATION OF OIL-AND-GAS FIELD RESERVES

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Ukraine has a standard procedure of development and substantiation of indexes and parameters of conditions for oil and gas reserves calculation and for indexes determination of economic-geological evaluation of hydrocarbon deposits, which are submitted to State expert review and valuation.

This procedure is mandatory for market participants, regardless of legal organizational form, form of ownership and submission. They perform geological study of subsurface resources in order to calculate oil and gas reserves and then provide state expert review with the materials on economic-geological evaluation of hydrocarbon deposits or prospects for oil-and-gas subsurface resources.

TECHNICAL AND ECONOMIC FEASIBILITY OF CONDITIONS FOR CALCULATION OF OIL-AND-GAS FIELD RESERVES

The following basic concepts are used in regard to technical and economic feasibility of conditions for calculation of oil-and-gas field reserves:

Indexes of conditions – reservoir properties characteristics of productive reservoirs, hydrocarbon fluids, occurrence conditions of productive pool deposits, which significantly influence on the selection of technological designs of hydrocarbon production and use, technical-and-economic efficiency of operating process and the financial results of produced salable production realization.

Parameters of conditions – limit values (minimum or maximum) of indexes of conditions, which are set for a deposit, district, lithostratigraphic horizon and estimate block on a basis of laboratory data analysis, industrial and geophysical experiments of filtration-capacitive properties of reservoirs, technical and economic assessments and experience of geological exploration and reserves development.

The basic principles of conditions development

Technical and economic feasibility of persistent and operational conditions is developed by the users of subsurface resources or by specialized design and scientific-research institutes, economic-geological subdivisions of enterprises, other business entities, which can provide a competent execution of present works.

The basic principles of conditions development

The conditions for reserve calculation of oil and gas deposits provide for the following main aspects for initial reservoir conditions:

- minimum opened porosity (cavitation) of reservoir;
- minimum absolute permeability of reservoir for hydrocarbon component of formation fluid, which is calculated;
- minimum oil and gas saturation of productive reservoir;
- maximum clay content of reservoir ;
- minimum net reservoir thickness;
- minimum net thickness of oil and gas deposit;
- minimum industrial content of associated commercial components in oil, gas and associated waters;
- optimum system of deposit pool development;
- minimum working pressure at the production well opening;
- minimum average work production rate of producer well on hydrocarbonic component;
- maximum water cuttings of well production;
- disposal price of hydrocarbonic salable production;
- optimum hydrocarbonic recovery factor.

Geoscience substantiation of conditions

The additional to the mentioned above indexes of conditions could be provided in case the estimated oil and gas object has the other circumstances that significantly affect determination of the quantity and quality of total and producing hydrocarbon reserves.

Geoscience substantiation of conditions

Geoscience substantiation manages with the indexes of conditions, which are connected with the geological structure of deposit, reservoir properties, productive pool delineation with an intersecting by the down hole and along the horizontal.

Technological justification of conditions

Technological justification of conditions

Technological justification of conditions should be performed on the basis of comparative analysis of technological parameters that belong to various development options of estimated deposits, which are specified due to usage of modern methods of geological and technological model experiment. The corresponding software products and manuals should be ordered from developers.

- The selection of development options is performed according to technological criteria taking into account the completeness and complexity of hydrocarbons usage, standards of gas and oil field development, and mineral resources and environment conservation requirements.

Technological justification of conditions

- The estimation of produced resources and extraction ratio of hydrocarbon are performed in accordance with project decisions on sorting out the production facilities, selection of formation stimulation method, well pattern, operation conditions and procedures etc. Produced resources are calculated for each deposit, production facility and for a field as a whole.

- Procedures and conditions selection of industrial deposit exploration should be performed in accordance with the results of alternative calculations of extraction coefficient and economic parameters of development effectiveness. In case one of development methods has an advantage, alternative calculations may not be performed. The quantity of calculation options for field development (deposit, production facility) has to be grounded.

Technological justification of conditions

- Technical and economic feasibility of conditions according to useful component content and its industrial value, should provide a specified variant, which allows to reach the maximum overall economic effect during the whole period of field development taking into account the maximum field production and a rational use of the main mineral product.

- Justification of hydrocarbon's volume losses during well surveying and planning of produced primary product to the standards of salable production is subject to working normative standards and is confirmed in process flow diagram (development project) of hydrocarbon deposits. Hydrocarbon losses depend on applied facilities, equipment, process system and its recording. The recording of produced products should be applied to each well and carried out at each object during work period.

Economic feasibility of conditions

Economical parameters of development are calculated on the basis of accepted technological decisions, special parameters and reviewed options of systems for field development of hydrocarbons.

The calculations are made according to the evaluation formula of net present object value.

$$NPV = \sum_{t=0}^{T} \frac{[(Дt - Bt) - Пt] + At]}{(1+E)^t} - \sum_{t=0}^{T} \frac{Kt}{(1+E)^t},$$

where NPV is Net Present Value, which is accumulated during the entire period of future production activities on an estimated geologic feature;

Economic feasibility of conditions

E - discount rate;

Дt - annual income (revenue) from realization of salable production during t-year;

***B*t** - maintenance cost, including amortization during t-year;

Пt - tax and compulsory payment rate in t-year, which are not included to the amount of maintenance expenditure;

***A*t** - amortization in t-year;

***K*t** – capital investments into the industrial construction in t-year, including further geological exploration;

T – usage period of subsurface of the evaluated geological feature for exploration and/or hydrocarbon production.

Economic feasibility of conditions

Economic feasibility of conditions should be applied in accordance with consistently applied principles of investment projects performance evaluation, such as:

1) the effectiveness of commercial field development (object) is specified for the whole period of productive activity of extractive enterprise – from the moment of evaluation till dissolution;

2) modeling of the cash flows is performed with account of all cash receipts, which are related to commercial development including investment and all expenses that were made during the years of specified work execution, which includes exploration of subsurface resources, field development, protection and revival of environment.

Economic feasibility of conditions

3) calculations are performed for the date of hydrocarbon reserves estimation using the procedure of discounting of future money flows in order to bring them to the equal terms during the start year;

4) when determining the effectiveness parameters of field development (deposits), only future expenses and revenues are included;

Technical-and-economic calculations should be performed with reference to the final hydrocarbonic salable production of extractive enterprise. The production should meet the requirements of relevant standards or specifications and is realized by users of subsurface resources.

Economic feasibility of conditions

The standard version *is mandatory for all appraisal objects submitted to state expert review. The calculations in it are made in accordance with specified normative documents of standard conditions:*

- discount rate that is applied to determine the value of reserves in-place, is equal to the current bank rate of the National Bank of Ukraine (hereinafter - the NBU) for conduction economic-geological evaluation;

- investment for the project implementation on field development and salable hydrocarbon production is accepted as such, being performed on account of user's own expenses;

Economic feasibility of conditions

- substantiation of economic parameters and parameters for conditions, which are specified by the agreements on product distribution, is not carried out;

- extraction of hydrocarbons, associated minerals and components, and preparation of them for sales is provided by traditional, familiar to the world technology systems of development;

- depreciation on mined deposits, for the date of reserves definition are determined with account of previously created capital funds.

Economic feasibility of conditions

Commercial Option is developed as an additional one to the subsoil user's solution. Feasibility calculations in this option can take into account conditions ensuring a more efficient, compared to the standard one, use of mineral resources including such that can be provided only by a specific subsoil users, namely:

- the use of key assets available for the field development and the associated reduction of capital expenses;

- use of higher consumer prices for the sale of marketable hydrocarbonic product, also by means of cooperation with the top technological level production;

Economic feasibility of conditions

- use of tax privileges, entitlement payment, donations and other types of supports to oil and gas production;
- introduction of highly innovative high performance technologies for search, mining and processing of hydrocarbonic product for selling and of areas of the marketable product use;
- application of discount rates which is higher or lower of the NBU accounting rate.

Economic feasibility of conditions

- For identification of the gas and oil mining marketable product cost, existing prices for the associated type and class of the hydrocarbonic product formed at commodities exchanges should be applied. Marketable product prices established on the basis of agreements with the consumers may be applied to establish its costs in case they are not lower than the stock ones.

- If the marketable hydrocarbonic product prices regulated by Law are below the stock ones, then the administered prices should be used for the cost determination of the mineral reserves of the allocated minefield or portion of subsurface, and for the determination of the hydrocarbon reserves balance participation stock prices should be applied.

Economic feasibility of conditions

- If the subsoil user is a business combination partner and sells its marketable hydrocarbonic product by internal prices of this combination, such prices may be used for the cost estimate in case they are above the stock or administered prices.

- Marketable hydrocarbonic product used by the subsoil user for its internal needs (included in the list of expenses) shall be accounted as gained and sold on a common basis.

- In exceptional cases, when the level of existing stock prices for marketable hydrocarbonic product does not ensure cost-effective field development (deposit occurrence), the subsoil user who develops or will develop a field, may, upon economic risk conditions, propose to use higher product selling prices or lower prices for mining equipment or services in his commercial option of feasibility study (TEF).

Economic feasibility of conditions

- Prices for materials, equipment, fuel and energy and other resources used for mining and processing of marketable hydrocarbonic product for selling should be accepted in the order of market (stock) prices existing at the time of valuation of prices. Contractual prices for equipment, hardware etc. may be used if they do not exceed the stock prices. Cost efficiency of ordering foreign-made equipment at prices highly exceeding those of the domestic one shall be justified separately.

- In the cost estimates, the labor rates and indices, average salary, depreciation charges and other prudential standards should be applied on the basis of laws and regulations effective at the time of estimate.

Economic feasibility of conditions

- In the valuation of the subsoil user's capital investments in the construction (reconstruction) of the oil and gas production enterprise use direct calculations, equivalent plants' performance indices, standard designs, consolidated cost estimate standards, standard provisions on planning, accounting and calculation of prime cost of drilling operations, construction, installation and other activities along with the other duly verified norms supplemented and amended as appropriate to address specific conditions.

- Direct calculations shall be used to estimate capital investments into the construction of boreholes and other construction and installation activities related to the field infrastructure development. Mining and other equipment costs shall be valuated using both, direct calculations and specific capital investments defined by the equivalent plants. Auxiliary production costs shall be applied in a similar manner; costs for road, power supply lines and water supply pipelines construction and the construction of other line structures spreading outside of the site boundary shall be estimated by direct calculations using equivalent patterns and consolidated specific indices of the estimated cost of their unit length.

Economic feasibility of conditions

- Capital investments into the future exploration works at some of minefield areas should be determined by consolidated cost estimates on the basis of direct definition of future work scopes.

- Cost estimates for environmental measures should be made using direct calculations using consolidated specific indices of standard environmental processes, structures, enterprises revised to address specific conditions of the object of feasibility study

- Compensation costs to cover the losses of the land-users and agricultural losses caused by the allocation of land for the construction of the mining enterprise, as well as the compensation costs to cover environmental disamenity shall be calculated by consolidated method on the basis of direct expenses or by direct calculations.

Economic feasibility of conditions

- Reclamation costs in respect of the land allocated for temporary use shall be defined on the basis of consolidated input normals for the mined-land reclamation.

- Depreciation charges shall be determined in accordance with effective Ukrainian law.

- In case a useful service (operation) of capital fund objects (assets) does not provide its complete depreciation according to statutory standards, it is permitted to apply a properly justified straight-line or other depreciation method in compliance with Generally Accepted Accounting Principles "Fixed capital".

Economic feasibility of conditions

- Maintenance cost should be separately determined for all main classes of works, which ensure the production of salable production (extraction, preparation for transportation and realization) and also summarily for enterprise with reference to calculation or analog data. Calculation of production cost of performed work on different field direction (geoexploration, construction and mounting, expert-constructive, industrial and other works) should be performed in accordance with operating field-methodic recommendations on formation of their production cost

Alternative technical and economic calculations on justification of economic commercial development feasibility should be made for each efficient deposit (production facility) in order to select the most optimum alternative.

Economic feasibility of conditions

When determining an optimum alternative of conditions for hydrocarbon reserves calculation, and correspondingly, an optimum alternative of industrial exploration of evaluating oil-and-gas object, an advantage should be given to the variant, which provides high extraction ratio of hydrocarbon from subsurface resources, maximum quantities of accumulated neat money flows, budget revenue and state special-purpose fund revenue, upon condition of a positive value of Net Present Value.

Main technical and economic indexes of field development according to optimum alternative

Index	Index value	Unit
The amount of designed / operating producing well	/	well
Depreciated cost capital fund (CF)		thous. UAH
Designed development time		years
Oil production		th. tonnes
Gas production		mmcm
Condensate production		th. tonnes
Oil selling price (net of VAT and rent)		UAH/t
Gas selling price (net of VAT and rent)		UAH/mcm
Condensate selling price (net of VAT and rent)		UAH/t
Volume of sales (net of VAT and rent)		thous. UAH
Maintenance expenditures		thous. UAH
Including amortization		thous. UAH

Main technical and economic indexes of field development according to optimum alternative

Index	Index value	Unit
Production cost: – gas – condensate – oil		 UAH/ mcm UAH/t UAH/t
Balance-sheet profit		thous. UAH
Profit tax (25%)		thous. UAH
Net profit		thous. UAH
Current capital investments (CI)		thous. UAH
Cumulative cash flow		thous. UAH
Net present value (NPV)		thous. UAH
Internal rate of return (IRR)		%
Cost effectiveness of productive activity: – for productive assets (CF and CI) – for maintenance expenditures		 % %
Payback period		years
Budget and state special-purpose fund revenue		thous. UAH

Thank you for your attention!