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Assessing the level of production capacity utilization in the country's oil and gas sector using aggregated information

Ocena poziomu wykorzystania mocy produkcyjnych w krajowym sektorze naftowym i gazowym przy zastosowaniu skumulowanych informacji

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ABSTRACT: Production capacity characterizes the capabilities of an enterprise to produce products. If the production capacity of an enterprise is not fully utilized, this leads to an increase in the share of fixed costs, an increase in production costs, and a decrease in profitability. The purpose of the study is to develop the theoretical foundations and development of methodological provisions for determining and using production capacities in the oil and gas sector of the country. The article discusses the process of assessing the level of capacity utilization in the country's oil and gas sector, which is justified by calculations of production capacity. When planning them, it is recommended to take into account the features of the drilling enterprise. In practice, the "number of completed well drilling" indicator plan is usually adopted as the main indicator at drilling enterprises. A rule has been proposed for determining the maximum quantity of the indicator "number of completed well drillings" as the main indicator of the activity of drilling enterprises in current production conditions. Then the number of wells a drilling company can deliver at its current production capacity is compared with the number of wells actually delivered. The actual utilization of production capacity in the industry is analyzed, its level of utilization, and the reasons associated with the deviation from the full utilization of equipment productivity are highlighted. When determining the level of production capacity utilization, the "maximum production capacity" indicator of drilling enterprises is calculated. Next, a model is proposed for calculating the level of production capacity utilization in the country's oil and gas sector. At the SOCAR (State Oil Company of the Azerbaijan Republic) company level, a cost expression is used to assess the level of capacity utilization. The reason for this is the variety of activities of the organizations included in the company and at the same time the variety of equipment. When analyzing the extent to which existing production capacity is used at the company level, it was proposed to use the indicator "limit of effective use of equipment". The results obtained showed that the proposed methods make it possible to assess the level of use of the equipment fleet and the activities of the enterprise or the company.

Key words: maximum production capacity, limit of effective use of equipment, turnover ratio.

STRESZCZENIE: Zdolność produkcyjna charakteryzuje możliwości przedsiębiorstwa w zakresie wytwarzania produktów. Jeśli zdolności produkcyjne przedsiębiorstwa nie są w pełni wykorzystywane, prowadzi to do wzrostu udziału kosztów stałych, wzrostu kosztów produkcji i spadku rentowności. Celem badania jest opracowanie podstaw teoretycznych i rozwój przepisów metodologicznych dotyczących określania i wykorzystywania zdolności produkcyjnych w sektorze naftowym i gazowym kraju. W artykule omówiono proces oceny poziomu wykorzystania zdolności produkcyjnych w krajowym sektorze naftowo-gazowym, który jest uzasadniony obliczeniami zdolności produkcyjnych. Przy ich planowaniu zaleca się uwzględnienie cech przedsięwzięcia wiertniczego. W praktyce plan wskaźnika „liczba ukończonych odwiertów" jest zwykle przyjmowany jako główny wskaźnik w firmach wiertniczych. Zaproponowano zasadę określania maksymalnej ilości wskaźnika „liczba wykonanych odwiertów" jako głównego wskaźnika działalności przedsiębiorstw wiertniczych w obecnych warunkach produkcyjnych. Następnie liczba odwiertów, które firma wiertnicza może wykonać przy obecnych zdolnościach produkcyjnych, jest porównywana z liczbą faktycznie wykonanych odwiertów. Analizowane jest rzeczywiste wykorzystanie mocy produkcyjnych w branży, poziom ich wykorzystania oraz przyczyny związane z odchyleniem od pełnego wykorzystania wydajności sprzętu. Przy określaniu poziomu wykorzystania zdolności produkcyjnych obliczany jest wskaźnik „maksymalnej zdolności produkcyjnej" firm wiertniczych. Następnie zaproponowano model obliczania poziomu wykorzystania mocy produkcyjnych w krajowym sektorze naftowo-gazowym. Na przykładzie spółki SOCAR (State Oil Company of the Azerbaijan Republic) do oceny poziomu wykorzystania mocy produkcyjnych stosuje się wyrażenie kosztowe. Powodem tego jest różnorodność działań organizacji wchodzących w skład spółki, a jednocześnie różnorodność sprzętu. Analizując stopień wykorzystania istniejących mocy produkcyjnych

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na poziomie firmy, zaproponowano wykorzystanie wskaźnika „limit efektywnego wykorzystania sprzętu". Uzyskane wyniki pokazały, że proponowane metody umożliwiają ocenę poziomu wykorzystania floty sprzętowej i działalności przedsiębiorstwa lub firmy.

Słowa kluczowe: maksymalna zdolność produkcyjna, granica efektywnego wykorzystania sprzętu, współczynnik obrotów.

Introduction

Production capacity can be determined both for the entire oil and gas sector of the country as a whole and for individual enterprises. To determine the maximum possible volume of product output, production enterprises that are involved in the main technological operations for the production of products and perform the largest volume of work in terms of complexity and labor intensity are taken as a basis.

One of the priority areas for the development of the country's oil and gas sector is to increase the depth of processing of energy resources. Oil refining involves the production of petroleum products, primarily automobile, aviation, and other fuels and raw materials for subsequent chemical processing. The main goals of the development strategy for the processing of energy resources are the creation of new capacities in the country's oil and gas sector, the modernization of raw materials and processing industries, increasing the depth of processing of raw materials, reducing the energy intensity of production and expanding the presence in world markets of final products (Mehtiyev and Tanriverdiyev, 2023).

Currently, industry enterprises use regulatory documents for calculating production capacities, focused only on maximizing the needs for oil and gas products. Aspects of the problem being studied in this direction were analyzed in scientific studies by such authors as Kurilov (2016) and Davydova (2018). Various aspects related to the determination and use of production capacity in oil and gas enterprises were investigated in the works of Karginova (2016) and Tertyshnik (2016). Features determining production capacity at chemical and petrochemical industry enterprises are considered by the authors (Baldwin et al., 2013; Savaş et al., 2019).

The productivity and quality of the industrial sector can be improved if industries expand their capacity or introduce advanced tools and techniques into their core activities, but such adoption directly increases unit costs. An alternative way to increase productivity and quality at lower unit costs is to make optimal use of available resources (Singh and Rathi, 2019). The capacity can be upgraded by balancing equipment amongst the sub-processes of the plants. Overall, the capacity is subjected to the intensiveness of use of the facilities and it possesses a large degree of vagueness, so it is hard to measure and manage (Jin et al., 2020). It can be measured mathematically with the help of an index called capacity utilization (CU) (Zhang et al., 2018).

The results of the literature analysis showed that the theoretical and methodological issues of the technical and economic analysis of the assessment of the level of capacity utilization in the oil and gas sector are not sufficiently developed and require further research.

Model for assessing the level of production capacity utilization in the oil and gas sector

In the oil and gas sector, capital-intensive areas are the fixed assets of the enterprise, and this forces management to change their attitude towards them. Fixed assets of an oil and gas enterprise, maintenance, and repair processes have specific monetary measurements. Therefore, company managers of oil and gas enterprises are largely interested in the problems of increasing the return on fixed assets, optimizing costs, the list of maintenance and repair work, and reducing production costs. Considering that the country's enterprises still have quite a lot of wear and tear on fixed assets, the transition to progressive methods of maintenance and repair, the introduction of modern drilling rigs, and the diagnostics of main technological equipment are becoming extremely urgent. Today, it is important to integrate all of the above subsystems into a single information space to support decision-making in the enterprise. The solution to these problems depends on the level of use of production capacity, the achievement of set goals, and the available information on the technical condition of the equipment.

This approach allows us to formulate optimal, integrated solutions for assessing the level of capacity utilization in the country's oil and gas sector, taking into account the peculiarities of the levels of aggregation information.

There are several methods for calculating production capacity at oil and gas enterprises:

- according to the technical power of electric motors, leading equipment and equipment performance;
- with the help of expert assessments, through analysis of the enterprise;
- according to the balance of production capacity;
- using the normative method.

When applying the leading equipment method, the composition of the elements that determine the size of production capacity is identified: the number of units of leading equipment, the operating time of a unit of equipment, and the productivity of a unit of equipment. All leading equipment installed

at the enterprise is taken into account when calculating production capacity.

In accordance with the purpose of the study, the following tasks were set:

- systematize existing theoretical approaches and clarify the definition of the concept of "production capacity in the oil and gas sector";
- define criteria and identify parameters for classifying types of production facilities;
- clarify the classification of factors influencing the production capacity of industry enterprises;
- develop a methodology for determining the maximum production capacity of industry enterprises;
- clarify the methodology and develop an algorithm for calculating reserves and standards for the use of production capacity in the country's sector using aggregated information.
- conduct an assessment of the efficiency of using production capacity at the level of enterprises and the country's oil and gas industry as a whole.

To facilitate the practical significance of the application of the obtained results, in accordance with the purpose of the study, analyses were conducted in the oil and gas sector of our country. To provide the country with liquid fuel, stabilize and increase production and complete recovery of residual oil, a large number of production, exploration, evaluation, etc. oil wells were drilled. The drilling of these wells and their operation involve large capital investments. Increasing the efficiency of capital investments aimed at production is the main issue of our time. Production efficiency and its improvement are a more important issue for the oil and gas industry. In today's competitive environment, the study of production efficiency is becoming increasingly relevant, which requires solving the economic problems of drilling in conditions of stabilization of oil and gas production. Stabilizing and increasing oil production depends, among other conditions, on the volume of oil obtained from newly drilled wells.

It is known that drilling enterprises operating in Azerbaijan carry out drilling operations at various drilling sites. For this reason, the system and level of indicators characterizing their activities are also different. This diversity ultimately determines the formation of SOCAR (State Oil Company of the Azerbaijan Republic) indicators. It should be noted that one of the indicators characterizing the efficiency of production in drilling is the indicator of the efficiency of using the drilling calendar-time balance. Ensuring continuity of production and minimizing non-productive time is of particular importance in improving the organization of production. A high share of non-productive time in drilling leads to a decrease in other economic indicators. Analysis of balance sheets shows the availability of resources to improve the organization and efficiency of production.

The analysis showed that recently the utilization rates of drilling rigs at SOCAR drilling enterprises have been tending to increase. This indicates the effective use of drilling rigs. Thus, during the analyzed period, this indicator tends to increase for all drilling enterprises. On the other hand, the coefficient of intensive use of drilling equipment is ahead of the coefficient of extensive use in all drilling enterprises. This indicates the presence of positive trends in the use of drilling rig power.

To increase the economic power of a country, it is necessary to drill a certain number of oil and gas wells to meet the energy needs of production areas and at the same time increase oil exports to the world market. Drilling wells depends on the production capacity of drilling enterprises, the geological conditions of the drilling site, and the level of development of the production organization. The production capacity of a drilling enterprise is determined depending on the number of drilling rigs in the enterprise's fleet, the average depth of wells delivered, and the equipment turnover ratio. The production capacity of the enterprise is determined by the number of wells commissioned during the reporting period. The production capacity of drilling enterprises is understood primarily as the "number of completed wells."

The production capacity of a drilling enterprise is the maximum opportunity to produce finished products with full use of existing fixed assets with extensive use of the latest achievements of science and technology, progressive technological processes, and advanced production experience over a certain period.

It is known that when calculating production capacity in a drilling organization, two main indicators are used. If the wells being drilled are similar in depth, technological features of drilling, and the design of drilling rigs, then the "number of completed wells" is taken as an indicator of production capacity. If the above characteristics of the wells being drilled are different, then "drilling in meters" is taken as an indicator of the production capacity of the drilling enterprises.

Using "drilling in meters" as the production capacity of a drilling department does not fully reflect reality. If we take into account that "drilled meters" are carried out in different conditions and at different depths, then it is known that each meter of drilling, drilled in different conditions and at different depths, is carried out at the expense of different costs of production capacity.

In practice, the "number of completed wells" indicator plan is usually adopted as the main indicator at drilling enterprises. It should be noted that this plan is also related to the "drilling in meters" plan. In general, it is important to take into account the "drilling in meters" indicator when modeling is carried out

to determine the "number of completed wells" indicator for drilling enterprises.

The research work proposed a rule for determining the maximum number of the indicator "number of completed wells" as the main indicator of drilling enterprises in current production conditions.

The total production capacity of drilling organizations characterizes the production capacity of the drilling rigs on its balance sheet. When calculating the level of utilization of drilling rig production capacity, it is necessary to take into account the "drilling rig turnover ratio", which reflects the level of effective use of drilling rigs. The "drilling rig turnover ratio" shows the level of production use of the entire fleet of drilling equipment on the balance sheet of drilling organizations and is calculated using the following formula:

$$K_{t.r.} = \frac{T_{park}}{T_{p.t.}} \tag{1}$$

were:

$K_{t.r.}$ – drilling rig turnover ratio,

T_{park} – calendar time of all drilling rigs in the drilling organization's park, hour,

$T_{p.t.}$ – annual balance of production time of a drilling enterprises, hour.

The calendar time (T_{park}) of all drilling rigs in the fleet of a drilling enterprise, given in formula (1), is determined by multiplying the number of drilling rigs by the number of hours in 1 year (365 · 24 = 8760).

$$T_{park} = N \cdot 8760 \tag{2}$$

were:

N – is the number of drilling rigs in the year under consideration.

When we say the "effect of the rotation coefficient of drilling rigs", it is understood as the level of using the depending drilling equipment against the time factor of the drilling rig. The duration of a drilling rig being in production is the sum of: the time the drilling rig is in the drilling process, the testing period, the period of construction and dismantling of the rig, the repair period of the rig, the reserve period of the rig, etc. Therefore, the rotation coefficient of the drilling rig is $K_{t.r.} > 1$. The closer this coefficient is to 1, the more efficiently the available production capacity of a given drilling enterprise is used.

Under existing production conditions, the maximum production capacity of a drilling enterprise or the maximum possible number of completed wells can be determined using the following empirical formula:

$$Q = \frac{\sum H}{H_{ave.}} K_{t.r.} \text{ or } Q = \frac{\sum H}{H_{ave.}} \cdot \frac{T_{park}}{T_{p.t.}} \tag{3}$$

were:

Q – Maximum production capacity of the drilling enterprise,

$\sum H$ – drilling in meters [m],

$H_{ave.}$ – average annual depth of commissioned wells [m].

The capacity of a drilling enterprise cannot be considered as a constant and precisely determined indicator in advance. This indicator increases with the introduction of advanced technologies, the involvement of high-quality equipment in the production process, the improvement of personnel qualifications, and the improvement of production organization.

In practice, the problem arises of how to evaluate production capacity at the Company level, which includes several production associations, divisions, and contractors. When conducting an assessment at the Company level, it is almost impossible to assess the level of production capacity utilization in physical terms due to the variety of activities of the enterprises included in it and at the same time the variety of their equipment. For this reason, when analyzing the use of the Company's production capacity, it is advisable to use monetary terms. However, using indicators in monetary terms also has disadvantages that are important to consider.

It is important to implement several measures to reduce the cost of the produced oil or gas. These measures include increasing the drilling speed, preventing accidents and complications, as well as maintaining the volume of production assets at an optimal level. The production capacity of some drilling rigs or equipment owned by oil and gas industry enterprises is partially or completely unused. As a result, the cost of the final product increases. Excess accumulated capacity often leads to excessive use of working capital. This makes it important to take into account the amount of annual working capital reserves when assessing the level of capacity utilization.

When analyzing the level of utilization of existing production capacity at the Company level, we propose to use the "limit of effective use of equipment" indicator. In the oil and gas industry, the indicator "limit of effective use of equipment" is an indicator of the economic efficiency of the amount of equipment in the production process. It characterizes the level of coordination of economic activity between different areas of production. This indicator is calculated using the following formula:

$$R = \frac{J_r}{F_f + F_w} \tag{4}$$

were:

R – limit of effective use of equipment,

J_r – revenues from the sale of crude oil and natural gas and other sources,

F_f – annual the carrying amount of fixed assets (equipment, buildings, and property),

F_w – the amount of annual working capital inventories.

These calculations were made at the level of SOCAR (State Oil Company of the Azerbaijan Republic) and its contracting organization.

Solution of the problem

Before calculating the "maximum production capacity" of a drilling facility by year, we will consider the indicators characterizing the technical level of the drilling complex of the contracting organization SOCAR, which was accepted as the object of study. Table 1 compiles information on the "set of drilling rigs" operated at the production sites of the contracting organization SOCAR as of 01/01/2014.

Table 1. Information on the "set of drilling rigs" of the contracting organization SOCAR in 2014

Tabela 1. Informacje na temat „zestawu urządzeń wiertniczych" firmy kontraktującej SOCAR w roku 2014

Drilling rigs	Total number [set]	Technical condition			
		operating condition	rented out	needed in overhaul	fully (written-off)
Uralmash-3D	5	5	–	–	–
Khazar-6	1	1	–	–	–
BU-Uralmash 6000/2000 PPEM	2	–	2	–	–
Uralmash-4E	5	5	–	–	–
Drilling rig GD-2100E (2500 HP)	1	–	–	–	1
BU-75	2	2	–	–	–
BU-5000 (Uralmash-5000 QUT)	2	–	–	–	2
BU-3000BD	6	6	–	–	–
Mobile drilling rig Ruslan UP-130/170	1	1	–	–	–
ZJ 50/3150	2	2	–	–	–
TOTAL	27	22	2	–	3

As can be seen from the table, as of January 1, 2014, the contracting organization SOCAR had 27 sets of drilling rigs (of which 1 set was mobile). Of these, 1 set of drilling rigs GD-2100E (2500 hp) and 2 sets of drilling rigs BU-5000 (Uralmash – 5000 QUI) were completely unsuitable for operation, and 2 sets of drilling rigs BU-Uralmash 6000/2000 PPEM were rented. It should be noted that in 2014, 391 types of drilling equipment were discontinued. This equipment was technically worn out, completely unsuitable for major repairs, and had an expired shelf life. To replace the removed drilling rigs, modern, faster drilling rigs and equipment that met new technical and technological requirements were purchased. ZJ-brand drilling rigs manufactured in the People's Republic of China for deep drilling were purchased and put into production. All this work is aimed at increasing productive time during drilling. Table 2 shows the composition of drilling rigs of the contracting organization SOCAR in 2021.

Table 2. Information on the "set of drilling rigs" of the contracting organization SOCAR in 2021

Tabela 2. Informacje na temat „zestawu urządzeń wiertniczych" firmy kontraktującej SOCAR w roku 2021

Drilling rigs	Total number, [set]	Technical condition		
		operating condition	needed in overhaul	fully (written-off)
Uralmash-3D	1	1	–	–
Khazar-6	1	–	–	1
Uralmash-5000 DQUT	2	–	–	2
BU-75	2	2	–	-
BU-3000 BD	6	3	1	2
NBO-160D drilling unit [set]	1	1	–	–
ZJ-50D	4	4	–	–
ZJ-40/225CZ mobile drilling units	2	2	–	–
ZJ-70/4500 DZM	1	1	–	–
ZJ-70 DBS	1	1	–	–
ZJ-30 D	1	1	–	–
ZJ-30 DBS	2	2	–	–
TOTAL	24	18	1	5

In 2021, the contracting organization had 24 sets of drilling rigs on its balance sheet. As can be seen from the table, the modernization of technical means used during drilling operations and the introduction of new progressive technologies continued in subsequent years.

At present, modern drilling rigs of Drillmec, Bentech, ZJ-30, ZJ-40, ZJ-50, and ZJ-70 brands are used to achieve high technical and economic indicators in the drilling process. The use of new types of drilling rigs when drilling deep wells provides conditions for the use of new equipment and technologies, telemetry systems, as well as new types of drilling solutions, which in turn prevents many accidents and complications. As a result, this leads to high drilling speed, better quality and cheaper wells.

During the research, using the "annual report" tables, technical and economic indicators were collected that characterize the level of capacity utilization of the SOCAR contracting organization, which are presented in Table 3.

First, let's calculate the drilling rig turnover rate by year using the data in Table 3 and formulas (1), (2).

For example:

$$K_{t.r.2009} = \frac{63 \cdot 8760}{183886} = 3.001$$

Using the coefficient we calculated, the indicators in Table 3, and formula (3), we can calculate the maximum number of wells that can be commissioned based on the capacity of drilling rigs on the balance sheet of the contracting organization SOCAR in 2009:

$$Q_{2009} = \frac{147848 \cdot 3.001}{1775} = 250$$

According to this rule, the "drilling rig turnover ratio" and "maximum production capacity" of drilling rigs for the period under review (2009–2022) were calculated for the contracting organization SOCAR and are presented in Table 4 in comparative order.

As can be seen from the table, in 2021, the contracting organization SOCAR used its existing production capacities more efficiently. In 2014, the removal of physically and morally worn-out facilities and equipment from the balance sheet of the enterprise, as well as their equipping with new, better equipment, yielded results in 2021–2022. Thus, in 2021–2022, the level of utilization of existing production capacities of drilling rigs was close to the maximum. The result of the analysis is graphically presented in Figure 1.

It should be noted that a large amount of non-productive time in calendar time, when all other variables remain constant, can result in delayed well commissioning. This,

Table 3. Technical and economic indicators characterizing the level of capacity utilization of the SOCAR contracting organization

Tabela 3. Wskaźniki techniczne i ekonomiczne charakteryzujące poziom wykorzystania mocy produkcyjnych firmy kontraktującej SOCAR

Indicators	Years					
	2009	2010	2011	2014	2021	2022
Drilling in meters [m]	147 848	108 892	122 754	116 894	124 654	111 106
Number of drilling rigs in the production process [in numbers]	63	34	29	22	18	17
Average annual depth of commissioned wells [meter]	1775	1652	1697	1715	1862	1807
Total-calendar time [hour]	213 034	219 311	189 384	180 308	159 066	129 434
Productive time [hour]	183 886	174 369	167 594	157 464	140 903	112 928
Non-productive time [hour]	29 148	44 972	21 790	22 844	18 163	16 507

Table 4. Comparison of the level of capacity utilization of the contracting organization SOCAR in 2009–2022

Tabela 4. Porównanie poziomu wykorzystania mocy produkcyjnych firmy kontraktującej SOCAR w latach 2009–2022

Indicators	Years					
	2009	2010	2011	2014	2021	2022
Actual number of wells delivered to the customer by the contractor [in numbers]	71	73	72	79	73	71
The maximum number of wells that can be commissioned based on the capacity of drilling rigs	250	113	110	83	75	81
Drilling rig turnover ratio	3.001	1.708	1.516	1.224	1.1194	1.319

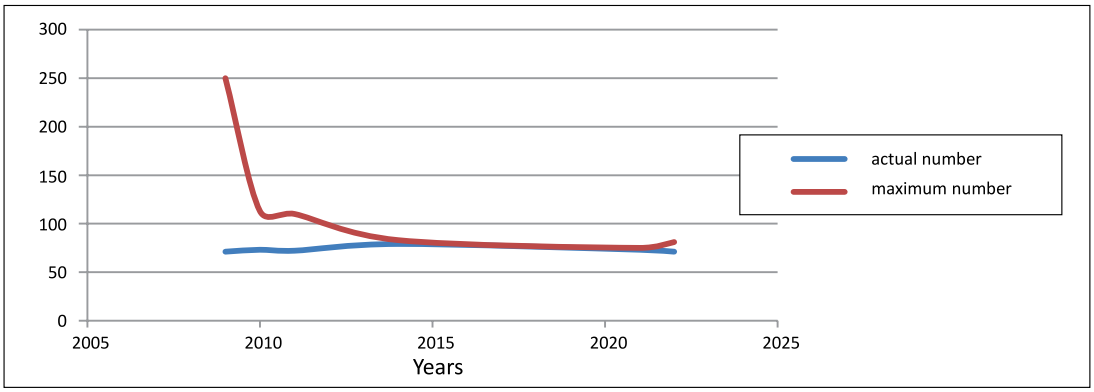

Figure 1. Comparison of the maximum production capacity of the enterprise with the actual volume of products supplied to the consumer

Rysunek 1. Porównanie maksymalnej zdolności produkcyjnej przedsiębiorstwa z rzeczywistą ilością produktów dostarczanych konsumentowi

in turn, leads to a decrease in a certain volume of oil and gas production. All these are very important issues from the point of view of production efficiency in market conditions. Solving such problems plays a certain role in the development of the oil industry and the country's economy as a whole. The diversity of the calendar and time structure of drilling enterprises is also associated with geological differences in drilling areas. Analysis of the calendar time balance also shows that auxiliary and repair work still have a large share of the total time.

From the above analysis, it became clear that in the future it is necessary to increase the volume of work delivered to the customer to such an extent that its volume ensures maximum use of the production capacity of existing equipment. If this is not possible, it is necessary to reduce the size of the fixed production assets by removing worn-out equipment that is not used in any process from production.

With increasing intervals during the drilling process, the time spent on preparatory and repair work increases, which is associated with the deepening of the well and the complication of work. An analysis of the literature showed that if the commercial speed of a well drilled at a depth of 2066 meters is taken as 100%, then at a depth of up to 3451 meters this figure is 48%, and at a depth of over 4000 meters this figure is 35%. As the depth of the wells increases, the standard limit of labor productivity also increases.

When assessing the level of use of equipment potential at the SOCAR company level, a cost expression was used.

Table 5 shows indicators characterizing the production capacity of SOCAR. Based on these indicators, the indicator "Limit of effective use of drilling equipment" (R) was determined using formula (4). For example:

$$R_{2022} = \frac{J_r}{F_f + F_w} = \frac{119228}{52770 + 2504} = 2.157$$

Using this formula, the economic activity of SOCAR in 2015–2022 was analyzed.

As can be seen from Table 5, the annual cost of fixed assets (F_i) for the period 2015–2022 at SOCAR increased by 2.8 times, mainly due to the renewal of the equipment fleet. Here, although the total quantity of equipment remained virtually unchanged, there was a change in quality. As a result of this qualitative change, SOCAR's profit for the period 2015–2022 increased by 6.86 times. During this period, the indicator "limit of effective use of drilling equipment" (R) increased by 1.35 times.

In 2016 and 2017, working capital reserves (4968 and 4819 million manat respectively) were high due to unsold crude oil. In effect, as a result of the sale of crude oil accumulated in previous years in 2017 and 2018, SOCAR's income increased, which led to an artificial increase in the "limit of effective use of equipment". This can be explained by the incorrect organization of SOCAR's marketing at that time.

As can be seen from the table, SOCAR's "limit for the effective use of equipment" was at its lowest level in 2020 (0.93443).

The analysis shows that the proposed rule makes it possible to assess both the level of use of the equipment fleet and the activities of the company as a whole.

The aforementioned methodology can be applied to drilling enterprises as well. In this case, the indicator "Revenue from the sale of crude oil and natural gas and other sources" should be replaced with the indicator "Volume of drilling operations."

Changes in the "limit of effective use of equipment" indicator also reflected in changes in SOCAR's profit. Calculations show that to ensure a "normal level of profit" in any organization, the "limit of effective use of equipment" must be higher than 2. This shows that there is a relationship between the

Table 5. Final indicators of the SOCAR financial report* and the indicator "Limit of effective use of drilling equipment"

Tabela 5. Wskaźniki końcowe sprawozdania finansowego SOCAR* oraz wskaźnik „Limit efektywnego wykorzystania sprzętu wiertniczego"

Years	Profit before tax	Revenues from the sale of crude oil and natural gas and other sources, J_r	Annual the carrying amount of fixed assets (equipment, buildings and property), F_f	The amount of annual working capital inventories, F_w	$F_i + F_d$	limit of effective use of equipment, R
2015	1.584	33.103	18.840	1.903	20.743	1.595864
2016	0.936	51.905	27.086	4.968	32.054	1.619299
2017	2.516	92.521	31.738	4.819	36.557	2.530870
2018	2.220	111.198	38.480	2.979	41.459	2.682120
2019	1.328	83.752	47.238	2.067	49.305	1.698651
2020	1.437	49.607	50.305	2.783	53.088	0.934430
2021	3.277	77.531	51.921	2.839	54.760	1.415833
2022	10.863	119.228	52.770	2.504	55.274	2.157036

* based on (SOCAR Financial Reports)

profit of the organization and the indicator "the limit of the effective use of equipment".

From the aforementioned analysis, it can be reasonably deduced that the utilization of drilling equipment should be at a level that allows the enterprise to operate at a profit. As can be seen from our example, a 1% increase in the effective use of drilling equipment leads to an increase in company revenue by approximately 1.6%. In this case, it is possible to predict such an optimal level of the indicator "limit of effective use of equipment", at which the organization can ensure a "normal rate of profit".

Determining the "limit of effective use of equipment" in the oil and gas industry allows us to assess the level of resolution in organizations of the following issues:

- determination of the cost of production facilities that are not fully involved or absent in the production process in organizations;
- determination of the optimal value of the "limit of effective use of drilling equipment", at which organizations provide a "normal level of profit";
- determination of the state of use of the organization's actual production capacity in the production process.

Conclusions

Drilling in the oil and gas industry is a capital-intensive area. Therefore, analysis of the use of production capacity of existing fixed assets at the enterprise level is a pressing issue. Capacity calculations are carried out to justify production plans and capital construction, assess the level of competitiveness, and develop production capacity balances and measures to reduce imbalances. When assessing the level of utilization of production capacity, the level of technical equipment of production is analyzed and intra-production reserves for increasing the efficiency of use of production capacity are identified.

As a result of the study, it became clear that the use of regulatory methods for assessing the level of capacity utilization in the production process in the oil and gas industry gives certain results only at the local level. This creates a need for new scientific research in this area to fully describe reality. Taking this into account, the article proposes new rules for analyzing the level of capacity utilization. The proposed rule was applied to a practical example at the contractor level and the results were analyzed. As a result of the analysis, it turned out that calculating the "maximum production capacity" indicator of an enterprise makes it possible to more adequately assess the level of production capacity utilization.

The assessment of the level of production capacity utilization in the research work was also carried out at the level of large companies. Considering that companies have a great structure, in this case a method was proposed for estimating production capacity by aggregating information in value terms. At the same time, a procedure for calculating the indicator "limit of effective use of equipment" was proposed and applied.

Analysis of the results showed that to improve the use of production capacity, an oil and gas sector needs to:

- reduce downtime of equipment;
- minimize working capital reserves;
- reduce the labor intensity of manufacturing a unit of product using the results of scientific and technological progress and re-equipment of production;
- improve the skills of key production workers;
- ensure the removal of obsolete equipment from production.

Thus, using the above formulas, it is possible to calculate the production capacity of the country's oil and gas sector both at the enterprise level and at the country level. With the proposed rules, one can analyze the level of use of drilling rigs and equipment, as well as determine the compatibility of production programs drawn up for the future period with the existing production capacity of a department or organization.

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