

PRODUCTION AND RESERVES OF THE WORLD'S LEADING PUBLICLY TRADED OIL AND GAS CORPORATIONS

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Abstract

Subject. The article considers the production and proved reserves of the twenty five leading publicly traded oil and gas companies from 2006 through 2018.

Objectives. The aim of the study is to determine the current level of values of the production and proved reserves of leading publicly traded oil and gas companies, as well as to identify key trends in their changes during the study period, to establish the factors that led to the changes.

Methods. The study rests on methods of comparative and financial-economic analysis, as well as generalization of materials of consolidated income statements.

Results. The paper established a practically commensurate growth in the production of liquid hydrocarbons and natural gas. It determined that most of the total production fell on liquid hydrocarbons. There was an increase in proved reserves, and the component of liquid hydrocarbons gradually reached almost two-thirds in the structure. The growth in the production of liquid hydrocarbons and natural gas outpaced the growth of the corresponding proved reserves in terms of its pace at the level of the world's leading publicly traded oil and gas corporations, and, therefore, there was a general decrease in the level of reserves to production ratio of companies. The indicators of proved reserves to production ratio inherent in the stock market sector of the oil and gas industry are mainly from 10 to 15 years. Therefore, the specified time range is a guideline in assessing the value of proved reserves life of liquid hydrocarbons and natural gas of publicly traded oil and gas corporations. It was determined that the largest publicly traded oil and gas corporations from Russia and Canada managed to strengthen their position in terms of operating indicators in the industry. The situation with production and proven reserves has become noticeably worse for most independent companies from the United States and corporations from China.

Conclusions. It becomes difficult for most independent companies to maintain an acceptable level of proved reserves to production ratio in the face of increasing production by leading oil and gas corporations at current prices for raw materials.

Keywords: production,
proved reserves, reserve
life, crude oil, natural gas

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Introduction

Domestic economists have been carrying out research aimed at studying various aspects of the financial and economic activities of oil and gas corporations, which are analyzed in the context of the entire global oil and gas industry, as well as at the level of countries or individual companies, for many years. Such attention to this topic, which has remained almost unchanged for a long time, indicates the importance of this direction not only for the domestic scientific community, but also for the entire country as a whole. The oil and gas industry still continues to play an important role in the Russian economy, which retains its raw materials nature. This is clearly reflected in the data on the structure of industrial production and commodity exports of the country. Consequently, proceeds from the sale of crude oil, natural gas and products from their processing together form an impressive part of the budget and fill the stabilization fund of Russia.

Large domestic oil and gas companies play a significant role in the national economy of the country. At the same time, in Russia, the leading corporations in the industry have the status of publicly traded joint-stock companies, whose shares are freely traded on the Moscow Exchange, and depositary receipts are traded on the iconic trading floors of the United States and a number of Western European countries. It turns out that the oil and gas sector also occupies key positions in the stock market segment of the country's economy. At the same time, it is worth noting that the corporations of the industry still continue to maintain a fairly high significance also on the scale of the entire global stock market.

Meanwhile, the specificity of the oil and gas industry lies in the instability of oil quotes, which makes all attempts to reliably predict them in a narrow confidence interval of values actually unrealizable even in the medium term. In addition, the industry has already faced two other shocks in this century that occurred even before the recent collapse in prices, which was facilitated by the completion of an agreement to reduce oil production between OPEC countries and Russia, Kazakhstan, Azerbaijan, as well as the growth of the pandemic. The global financial crisis, and then a long purely sectoral shock a few years later, were accompanied by a serious drop in oil prices (*Table 1*). And the time range between the crises is notable for the fact that average prices rose to their highest levels in the specified period.

Operating performance data, including the physical production and sales of crude oil and natural gas, as well as estimated values of their proved reserves, are of great importance for publicly traded oil and gas companies in such unpredictable environment, along with information from financial statements and from the results of exchange trading in shares. Moreover, information on the production and sale of refined products and petrochemicals also applies to them in the case of integrated corporations. All of these indicators make it possible to compare not only publicly traded companies in the industry, but also to compare with over-the-counter corporations. In addition, operational data are used in comparing oil and gas companies with significantly different scales of activity through

specific coefficients, which are also applicable in assessing the possible value of non-exchange corporations in the industry. Nevertheless, it is production and proved reserves of hydrocarbons that still remain key operating indicators. Therefore, it is quite natural that the domestic scientific community pays close attention to them, which is expressed in the impressive number of works, where these indicators are reflected.

Thus, operational indicators are used [1] as part of the formation of the main directions and are the target parameters of the development strategy of publicly traded companies in the industry [2]. Also, production and reserves are included in the key indicators [3] and are one of the most important components in conducting a comprehensive assessment of the effectiveness of operating activities [4] of oil and gas companies [5] as usual. Production is also proposed to be used when conducting strategic controlling within the framework of the current balanced scorecard [6]. The need to achieve a certain level of production is also among the significant strategic goals of industry companies [7]. Resources are also indicated as important parameters in the development of the concept of sustainable [8] and balanced [9] development of corporations, as well as in the very assessment [10] and determination of prospects [11] in the fuel and energy complex [12]. Operational indicators are studied when identifying the main development trends in the oil and gas sector of individual regions of Russia [13]. It should be noted that the authors also study foreign experience in the formation of global strategies for oil companies [14].

The resource base of companies is also taken into account when analyzing the key aspects of consolidation in the industry [15]. It is noteworthy that operating indicators are given not only among the strategic advantages of mergers and acquisitions in the oil and gas complex [16], but also in relation to the entire investment policy of industry companies [17]. In this context, such an important aspect for any publicly traded oil and gas company as the level of competitiveness [18] is worth mentioning. Production and reserves are also significant indicators [19] in the development of an integrated approach [20] to assessing the level of economic security. And the availability of reserves [21] is taken into account when analyzing those factors that affect the values of oil prices. At the same time, approaches are being explored to assess the involvement of hydrocarbons in the economic turnover and the security of their production [22]. Nevertheless, the scientific community notes the deterioration of the resource base in qualitative and quantitative terms [23]. In addition, the resource potential is also considered as the basis for the restructuring of the entire domestic economy [24].

It is quite expected that positioning features [25] are determined, and the place of individual large domestic companies [26] and Russia as a whole [27] in the global crude oil and natural gas market is assessed based on operational indicators. It should be noted that reserves indicators are also important in developing a methodology [28] and assessing [29] the fair value of developing an oil field. And quite a lot of attention is paid to production, reserves and their availability when studying the consequences of the tax maneuver in the domestic oil and gas sector [30]. Production and proved reserves are

significant parameters when developing a model for testing the assets of industry corporations for impairment [31].

It should be noted that the domestic scientific community still does not fully cover the topic devoted to the study of the values of production and proved reserves at the level of the entire stock market segment of the global oil and gas industry, despite a significant number of published works that pay sufficient attention to various operational indicators of oil and gas companies. In addition, key trends are not identified, and the main reasons for the transformations taking place within the large publicly traded companies of the industry are not established. It is worth considering the complexity of conducting such studies, which is due to the fact that it is necessary to collect and then process an impressive array of data over a fairly long period of time and for a significant number of publicly traded oil and gas companies. At the same time, it will be possible to form the most reliable idea of situation that is developing with the main operating indicators in the stock market segment of the global oil and gas industry, only if all the indicated conditions are met.

Methodology for the formation of the list of the world's leading publicly traded oil and gas corporations

The key principles for comprehensive and large-scale research are those principles, on the basis of which companies are selected and included in the list of the world's leading publicly traded oil and gas corporations for the subsequent formation of industry indicators. The key parameter is market capitalization in the case of publicly traded companies in the industry, whose shares are freely traded on various stock exchanges around the world. Therefore, it is the market valuation of equity capital that should be used as the desired parameter when ranking companies to form a list of leading publicly traded corporations in the oil and gas industry.

But at the same time, the stock market segment of the world economy includes a huge number of companies from various industries, among which there are enough corporations representing the oil and gas sector. Therefore, the availability of reliable data sources, on the basis of which it is possible to carry out a correct retrospective analysis to compile a list of the largest publicly traded oil and gas companies for a long period of time, is of particular importance. The listed criteria correspond to the Financial Times Global 500¹ rating published until 2015 and the Forbes Global 2000² list that still exists, where information on the market capitalization of the world's largest publicly traded companies is just given. It is necessary to include in the list of leading publicly traded oil and gas companies required for subsequent research only those of them that were relatively stable in each of the ratings issued at that time within the entire period under consideration.

¹ FT Global 500. URL: <http://im.ft-static.com/content/images/b38c350e-169d-11e5-b07f-00144feabdc0.xls>

² Forbes Global 2000. URL: <http://www.forbes.com/global2000/list>

As a result of a detailed analysis of all sources published during the studied period, it was established that 25 oil and gas corporations quite satisfy the criteria. The largest number of companies from the generated list belongs to the US oil and gas industry. And such leadership is quite predictable due to the fact that there are many more large publicly traded companies concentrated in the USA than in any other country in the world. The resulting list includes independent companies ConocoPhillips, Occidental Petroleum, Devon Energy, Anadarko Petroleum, EOG Resources, Apache and Marathon Oil, as well as well-known transnational integrated corporations such as ExxonMobil and Chevron.

In addition, the general list contains companies from another country located in North America, which is Canada. These include the integrated corporations Imperial Oil, Suncor Energy, Husky Energy and also the purely independent company Canadian Natural Resources. The list also includes a company from South America, which is a large integrated corporation Petrobras from Brazil. And the integrated corporations Royal Dutch Shell, BP, TOTAL, Eni and Equinor collectively represent the countries of Western Europe. The independent company CNOOC and the integrated corporations Sinopec and PetroChina from the resulting list are based in China. Domestic oil and gas companies PAO Gazprom, PAO NK Rosneft, and PAO LUKOIL included in the above list are also integrated corporations. All these corporations form the list of leading publicly traded oil and gas companies, on the basis of which the level of operational indicators inherent in the entire stock market segment of the industry is further determined.

Dynamics of changes in production of the leading publicly traded oil and gas companies

It is important to note that data on production and reserves of various liquid hydrocarbons are given in tons and barrels, while cubic meters and feet are used in the case of natural gas as part of the officially published reports of the largest oil and gas companies. But it is necessary to bring all operational indicators to a single generally accepted unit of measurement for the subsequent comparison, which for the oil and gas industry is a barrel of oil equivalent. Most industry companies report information in barrels of oil equivalent (BOE) using their own conversion factors. But it is acceptable to use standard industry values, according to which 1 barrel of oil equivalent has 0.134 tons of oil equivalent, 6,000 cubic feet, or 0.17 cubic meters in the absence of such.

One of the key operating indicators for any oil and gas corporation is traditionally the production of liquid hydrocarbons (*Table 2*), which is displayed in barrels of oil equivalent per day. It should be clarified that the general term liquid hydrocarbons includes crude oil, bitumen and gas condensate, which not only have tangible differences in physical properties, but also have significant differences in unit cost per barrel. It should be clarified that the general term liquid hydrocarbons includes crude oil, bitumen and gas condensate, which not only have tangible differences in physical properties, but also have significant distinctions in unit cost per barrel. It is noteworthy that the value of the liquid hydrocarbon production indicator, which is typical for the leading publicly

traded oil and gas companies, has increased markedly over the entire study period (*Figure 1*). In addition, the global financial crisis did not have a significant impact on the overall figure. And the main increase began shortly before the sectoral crisis, after which the upward trend continued.

Meanwhile, the indicators of ExxonMobil, ConocoPhillips, Husky Energy, Royal Dutch Shell, BP, Eni, and PAO LUKOIL have declined over the period studied despite the indicated dynamics. It is worth noting that a number of leading publicly traded oil and gas companies were marked by rather large mergers and acquisitions within the period under review. So, ExxonMobil acquired XTO Energy in 2010, and Royal Dutch Shell bought BG Group in 2016, but these companies mainly had gas assets, and, therefore, these agreements did not seriously affect the level of production of liquid hydrocarbons. It is also important to note the merger of Statoil and Norsk Hydro in 2007, as well as the merger of Suncor and PetroCanada in 2009. In addition, CNOOC acquired the Canadian company Nexen in 2013. And PAO NK Rosneft was noted for two major events at once. The company took over TNK-BP in 2013, and completed all the formalities for the purchase of a controlling stake in PAO ANK Bashneft in 2016. At the same time, transactions by Suncor Energy, Equinor, CNOOC and PAO NK Rosneft contributed to a significant increase in the daily production of the companies.

Canadian Natural Resources also experienced quite impressive growth. But EOG Resources deserves special attention, as its indicators is a clear confirmation of the very successful implementation the corporation's strategy for the purchase and subsequent development of predominantly oil assets with high liquidity. At the same time, integrated corporations occupy key positions among the leading publicly traded companies. Moreover, the top position belongs to domestic company PAO NK Rosneft, and PAO Gazprom, which is mainly focused on the extraction of natural gas, closes the top ten companies.

The largest publicly traded oil and gas companies also increased their total natural gas production over the period covered by the study (*Figure 2*). Moreover, the absolute increase in the total value exceeded the corresponding indicator for the production of liquid hydrocarbons. At the same time, indicators of natural gas extraction are noticeably inferior in terms of their level to the production of liquid hydrocarbons. It should also be noted that the global financial and industry crises led to short recessions, after which the growth of the industry indicator continued. However, the daily target for natural gas production has declined for most of the leading corporations from the US and Canada over the entire period. These include ConocoPhillips, Devon Energy, Anadarko Petroleum, EOG Resources, Apache, Imperial Oil, and Husky Energy, as well as Suncor Energy, which has reduced its own natural gas production to zero. And ExxonMobil was not included in this list only due to already mentioned deal to acquire gas company XTO Energy, a fairly large competitor in the US oil and gas industry.

It is also natural that the purchase of BG Group contributed to the growth of natural gas production from Royal Dutch Shell, and the growth rate was slightly higher than that of the leading publicly traded companies as a whole. In turn, Equinor, PetroChina, Sinopec, CNOOC, PAO NK Rosneft, and PAO LUKOIL managed to more than double their daily natural gas production. However, the undisputed leader in terms of natural gas recovery in the stock market sector of the oil and gas industry throughout the entire period under review is PAO Gazprom. The corporation exceeds, in terms of production, almost five times the data of the nearest competitor, which was Royal Dutch Shell at the end of the studied period. Moreover, it is integrated corporations that are in key roles in the production of natural gas among the leading publicly traded oil and gas companies.

It is quite expected that the total daily production of liquid hydrocarbons and natural gas by large publicly traded companies in the industry also increased (*Figure 3*). The increase for corporations such as EOG Resources, Suncor Energy, Equinor, PetroChina, Sinopec, CNOOC, and PAO NK Rosneft turned out to be higher than the level of leading publicly traded companies in general, which was also supported by major M&A deals made by some of them. But the daily figures for the production of liquid hydrocarbons and natural gas from ExxonMobil, ConocoPhillips, Devon Energy, Apache, Husky Energy, and BP decreased over the entire studied period.

Meanwhile, the ratio between liquid hydrocarbons and natural gas in the total production of industry companies is also an important point. Thus, the leading publicly traded corporations are mostly focused on the production of liquid hydrocarbons, the share of which reaches an average of approximately 55% of the total in barrels of oil equivalent. But at the same time, the share of liquid hydrocarbons in total production decreased for ExxonMobil, Royal Dutch Shell, and PAO NK Rosneft, which was affected by the already described major transactions of these corporations with assets. In addition, BP, TOTAL, Eni, Equinor, PetroChina, Sinopec, and PAO LUKOIL also have a very tangible reduction.

In turn, the liquid hydrocarbon component in the total recovery of Imperial Oil and Canadian Natural Resources increased noticeably over the entire period, while the share of natural gas in production at Suncor Energy completely disappeared. Moreover, Devon Energy, Anadarko Petroleum, EOG Resources, and Apache have evolved over time from predominantly gas companies to corporations focused on liquid hydrocarbon recovery. On the contrary, the gas component in the total hydrocarbon production of Royal Dutch Shell and Eni gradually came to the fore. It is also important to point out that PAO Gazprom stands out among all studied publicly traded oil and gas companies not only by its leadership in terms of total daily hydrocarbon production, but also by the uncharacteristic structure of hydrocarbon extraction for other corporations, in which the overwhelming component is natural gas. PAO NK Rosneft and PetroChina are in the second and third positions respectively, followed by the largest integrated companies in the US and Europe.

Dynamics of changes in proved reserves of the leading publicly traded oil and gas companies

The next components of the group under study are expected to be those operating indicators that characterize the level of various types of reserves. However, proper ranking of oil and gas companies by reserves is more difficult than matching by production. This feature is due to the fact that reserves are an estimated value, to the establishment of which a generally accepted approach has not yet been developed within the framework of the entire global oil and gas industry. For example, Russia has adopted the Classification of Reserves and Probable Resources of Oil and Combustible Gases developed by the Ministry of Natural Resources of the Russian Federation, while Kazakhstan has a very similar Classification of Field Reserves, Prospective and Probable Resources of Oil and Natural Hydrocarbon Gas of the Ministry of Energy and Natural Resources of the country. The standards applied in Russia and Kazakhstan are based on geological knowledge and the degree of commercial development of resources, which, according to the classification, are divided into reliable (A), established (B), estimated (C1) and inferred (C2) reserves.

North American countries also have their own classifications. These include National Instrument 51-101, also known as the Standards of Disclosure for Mineral Projects, which is used by the Canadian Securities Administrators (CSA) in the country. But the most widely used in practice are the rules of the US Securities and Exchange Commission (SEC), as well as the classification according to the Petroleum Resource Management System (PRMS) proposed by the Society of Petroleum Engineers (SPE) located in the same country. All these classifications are based on geological and engineering data, but they also take into account current production and economic conditions. Resources are divided into proved (1P), probable (2P), possible (3P) reserves in accordance with the classification adopted by SPE-PRMS. And companies, in their reporting under the SEC classification, disclose only proved reserves.

The amount of reserves calculated on their basis turns out to be significantly lower than those values that are determined in accordance with the methods used at the State level in Russia and Kazakhstan. This is due to the fact that the CSA, SPE-PRMS, and SEC classifications also take into account the economic component. The most stringent are the rules based on the SEC methodology for estimating proved reserves. This classification is most widely used in the stock market sector of the industry, and, therefore, is more preferable for comparison, due to the fact that shares and depository receipts of most large publicly traded companies in the industry are traded on US exchanges. But it is quite appropriate to use information on proved reserves based on SPE-PRMS and CSA classifications in the absence of data under SEC methodology. However, only PAO Gazprom is limited to one SPE-PRMS methodology, and Suncor Energy applies CSA rules from the entire list of companies considered.

It is noteworthy that the total proved reserves of liquid hydrocarbons of the leading publicly traded oil and gas corporations also increased (*Figure 4*) against the backdrop of increasing daily production. It turns out that a set of measures for exploration, the purchase of fields and the implementation of mergers and acquisitions, as well as the increase in oil prices, together allowed not only to compensate for the extracted resources, but also to increase the indicators of proved reserves of liquid hydrocarbons in the companies under study. It is also quite predictable that there has been a decrease in the total level of proved reserves in the stock market sector of the industry during periods of low oil prices. These results are related to the fact that there is also a decrease in the estimated value of proved reserves, the extraction of which remains economically justified, with a decrease in oil prices.

Proved liquid hydrocarbon reserves for Chevron, Occidental Petroleum, Anadarko Petroleum, Apache, TOTAL, Petrobras, and PAO LUKOIL declined over the entire period covered by the study, while for ConocoPhillips, PetroChina, and Sinopec, the decline turned out to be quite significant despite the overall growth. But the increase in this kind of reserves at EOG Resources, Imperial Oil, Suncor Energy, Canadian Natural Resources, Equinor, CNOOC and PAO NK Rosneft exceeded the growth inherent in the studied companies as a whole. Moreover, transactions with assets implemented by PAO NK Rosneft led to the fact that the company became the undisputed leader in this indicator in the entire stock market sector of the industry at the end of the whole period. PAO LUKOIL and predominantly gas PAO Gazprom are also among the top five in terms of proved reserves of liquid hydrocarbons, while independent US companies and Husky Energy are characterized by the lowest estimated values of this indicator.

Growth is also typical for the total proved reserves of natural gas of the leading publicly traded oil and gas corporations (*Figure 5*), which was not affected even by the global financial crisis. Nevertheless, there was a downward trend already at the height of the sectoral crisis, which then also manifested itself after a short-time increase in value. But the value of proved reserves of natural gas decreased for ExxonMobil, Imperial Oil, Husky Energy, Royal Dutch Shell, CNOOC, Petrobras, and PAO LUKOIL over the period studied. ConocoPhillips, Devon Energy, Anadarko Petroleum, EOG Resources, Apache, Marathon Oil also experienced a reduction, but the drop in the indicator for these companies turned out to be very significant for them, and proved natural gas reserves for Suncor Energy dropped to almost zero. It is noteworthy that ExxonMobil and Royal Dutch Shell declined even despite the purchase of rather large competitors, which had mainly gas assets.

At the same time, Chevron, TOTAL, Eni, Equinor, PetroChina, and Sinopec showed significant increases in proved natural gas reserves during the study period. Moreover, this indicator increased by an order of magnitude for PAO NK Rosneft, which was facilitated by the transactions carried out by the corporation on the takeover of TNK-BP and the purchase of a controlling stake in PAO ANK Bashneft. But PAO Gazprom naturally prevails in the stock market segment of the industry, whose share was

approximately 60% of the total proved reserves of all the studied publicly traded companies in the industry. In addition, PAO NK Rosneft and PAO LUKOIL are in the top ten list, which includes only integrated corporations. Therefore, it is natural that independent corporations from the United States and companies from Canada have the lowest values of proved reserves of natural gas.

It is quite obvious that the total proved reserves of liquid hydrocarbons and natural gas also increased in aggregate at large publicly traded oil and gas companies (*Figure 6*). At the same time, the component of liquid hydrocarbons in the total structure of proved reserves of corporations increased gradually from 60% to 65% over the studied period. Meanwhile, the performance of a number of companies in the industry declined. This list includes Occidental Petroleum, Devon Energy, Husky Energy, Royal Dutch Shell, Petrobras, and PAO LUKOIL. In addition, they include ConocoPhillips, Anadarko Petroleum, Apache, and Sinopec, whose total proved reserves have fallen quite impressively on a corporate scale. In turn, ExxonMobil, Devon Energy, Anadarko Petroleum, EOG Resources, Apache, Marathon Oil, Canadian Natural Resources, and Equinor showed a significant increase in total proved reserves over the period.

Certain transformations in the ratio of liquid hydrocarbons and natural gas in the structure of proved reserves of individual publicly traded oil and gas companies should also be noted. Thus, the share of liquid hydrocarbons slightly decreased at Occidental Petroleum, Eni, and PAO LUKOIL against the backdrop of a general increase, and such a decline turned out to be quite significant at Chevron, TOTAL, PetroChina, Sinopec, and PAO NK Rosneft. Attention is drawn to changes in the structure of proved reserves of EOG Resources, which has turned from an almost purely gas company into a predominantly oil corporation. This is also true for production indicators. Similar changes are also characteristic of Devon Energy, Anadarko Petroleum, and Apache. But a reverse trend manifested itself in the ratio between liquid hydrocarbons and natural gas at Eni and PetroChina. It is worth noting that a high share of liquid hydrocarbons in the total structure of proved reserves compared to competitors is typical for Marathon Oil, Imperial Oil, Suncor Energy, Canadian Natural Resources, and Petrobras, while the opposite situation is observed for PetroChina and PAO Gazprom.

Dynamics of changes in proved reserves life of the leading publicly traded oil and gas companies

Information on production and the level of available resources is used to form another important operational indicator, which is the proved reserves life of the company. The indicator characterizes the ratio of the values of proved reserves available to an oil and gas corporation at a certain point in time to the current level of annual production. Proved reserves life reflects the number of years it will take an oil and gas corporation to extract all the resources whose extraction is economically justified under the conditions then prevailing.

There is a slight final decrease in the level of proved reserves life characteristic of the leading publicly traded oil and gas corporations in the case of liquid hydrocarbons (*Figure 7*). Nevertheless, the indicator was located in a rather narrow range between 12 and 15 years for almost the entire period studied. It is natural that the highest values were noted during the period of high oil quotations, and the lowest values were recorded during a long industry crisis. It should be noted that the global financial crisis did not have a significant impact on the total value of proved reserves life of liquid hydrocarbons of the largest publicly traded companies.

Meanwhile, ExxonMobil, EOG Resources, Marathon Oil, Imperial Oil, Suncor Energy, Husky Energy, Royal Dutch Shell, BP, Eni, and Equinor even managed to increase their own performance over the period. On the contrary, Anadarko Petroleum, Apache, PetroChina, and Sinopec experienced impressive declines during the period studied. Moreover, it deserves special attention that the proved reserves life of liquid hydrocarbons fell at once for a number of companies from the US and Canada during the protracted industry crisis. These include Marathon Oil, ConocoPhillips, Devon Energy, Imperial Oil, Suncor Energy, and Husky Energy. Proved reserves life of liquid hydrocarbons in such oil and gas companies as Devon Energy, Anadarko Petroleum, Apache, Husky Energy, Royal Dutch Shell, Equinor, PetroChina, Sinopec, and CNOOC did not exceed ten years. At the same time, ExxonMobil, Imperial Oil, Suncor Energy, Canadian Natural Resources, BP, as well as large domestic publicly traded companies are not experiencing any particular difficulties with proved reserves life of such resources.

However, the proved reserves life of natural gas of the leading publicly traded oil and gas corporations has seriously decreased over the entire period (*Figure 8*) and almost equaled the corresponding indicator for liquid hydrocarbons in terms of its level. Moreover, the general downward trend temporarily weakened only in a favorable period of high oil prices. The growth of the indicator occurred at Chevron, Devon Energy, Imperial Oil, and PAO NK Rosneft despite the overall noticeable decrease. On the contrary, the proved reserves life of natural gas fell at Anadarko Petroleum, Apache, Marathon Oil, Equinor, PetroChina, Sinopec, CNOOC, Petrobras, and PAO LUKOIL much more than for the studied companies as a whole.

It is noteworthy that the proved reserves life of this type of hydrocarbons also significantly decreased for ExxonMobil and Royal Dutch Shell, which were noted for quite large mergers and acquisitions with gas assets within the covered period. In addition, the specified figure for Suncor Energy is no longer subject to determination due to the fact that the corporation has completely stopped extracting natural gas. In addition, the proved reserves life of natural gas has fallen below ten years for most companies, as a result. These include Anadarko Petroleum, Apache, Marathon Oil, Husky Energy, Canadian Natural Resources, Royal Dutch Shell, Equinor, Sinopec, and Petrobras. The proved reserves of natural gas of Marathon Oil remained only for a few years of production in the economic conditions that were available at that time. On the contrary, leading domestic

corporations and PetroChina differed from their competitors in the stock market segment of the industry by significant proved life reserves of natural gas.

It is natural that the total proved reserves life of hydrocarbons also decreased slightly over the period under study (*Figure 9*). It is also quite expected that higher values were noted during a favorable period for the oil and gas sector, and the indicator reached its lowest value at the very height of the industry crisis. Meanwhile, ExxonMobil, Imperial Oil, Suncor Energy, Husky Energy, Canadian Natural Resources, BP, and Eni were able to increase their proved reserves life for hydrocarbons. Moreover, the increase in the indicator of Imperial Oil and Suncor Energy turned out to be quite significant. On the contrary, Anadarko Petroleum, Apache, PetroChina, Sinopec, CNOOC, and PAO LUKOIL showed a significant decrease in proved reserves life of hydrocarbons compared to competitors.

In addition, the proved reserves life of hydrocarbons for Devon Energy, Anadarko Petroleum, Apache, Marathon Oil, Husky Energy, Royal Dutch Shell, Equinor, Sinopec, and CNOOC does not reach ten years, as a result. This figure for Anadarko Petroleum and Sinopec barely exceeded the modest level of six years at all. At the same time, the largest domestic oil and gas corporations, as well as ExxonMobil, Imperial Oil, and Canadian Natural Resources did not experience any particular difficulties with the proved reserves life of hydrocarbons. The figure for most of leading publicly traded oil and gas corporations of the world was often in the range of 10 to 15 years.

Conclusions

A comprehensive analysis of the production and reserves of the leading publicly traded oil and gas corporations of the world makes it possible to draw a number of conclusions regarding the changes in the stock market segment of the industry that occurred within the studied period.

Thus, a practically commensurate growth in the production of liquid hydrocarbons and natural gas has been established. It was determined that most of the total production was accounted for by liquid hydrocarbons. It was revealed that there was also an increase in the indicators of proved reserves. Moreover, the component of liquid hydrocarbons in the structure of proved reserves gradually reached almost two thirds. It has been established that the increase in the production of liquid hydrocarbons and natural gas at the level of the leading publicly traded oil and gas corporations of the world outstripped the growth of the corresponding proved reserves in terms of its pace, and, therefore, there was a general decrease in the level of proved reserves life of companies. It was revealed that the indicators of proved reserves life inherent in the stock market sector of the oil and gas industry are mainly from 10 to 15 years. Therefore, the indicated time range is a guideline in assessing the value of proved reserves life of liquid hydrocarbons and natural gas of publicly traded oil and gas corporations.

It is also determined that integrated corporations, among which large domestic companies are in key positions, are leading in terms of production, reserves and proved reserves life in the stock market segment of the industry. In addition, high indicators of proved reserves life of hydrocarbons are inherent in ExxonMobil, Imperial Oil, Suncor Energy, and Canadian Natural Resources. On the contrary, the indicator did not reach 10 years for Devon Energy, Anadarko Petroleum, Apache, Marathon Oil, Husky Energy, Royal Dutch Shell, Equinor, Sinopec, and CNOOC, as a result. It turns out that the largest publicly traded oil and gas corporations from Russia and Canada managed to strengthen their position in terms of operating indicators in the industry. Meanwhile, the situation with production and proved reserves has become noticeably worse for most independent US companies and Chinese corporations.

Table 1**The average price for WTI and Brent crude oil for 1999–2018, USD per barrel**

Benchmark crude	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
WTI	19.34	30.38	25.98	26.18	31.08	41.51	56.64	66.05	72.34	99.67
Brent	17.9	28.66	24.46	24.99	28.85	38.26	54.57	65.16	72.44	96.94

Continuation of the table

Benchmark crude	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
WTI	61.95	79.48	94.88	94.05	97.98	93.17	48.66	43.29	50.80	65.23
Brent	61.74	79.61	111.26	111.63	108.56	98.97	52.32	43.64	54.13	71.34

Source: Authoring, based on U.S. Energy Information Administration data. URL: <https://www.eia.gov>

Table 2**The average values of key indicators for production and reserves of the twenty five leading publicly traded oil and gas corporations for 2006–2018**

Indicator	2006	2007	2008	2009	2010	2011	2012
Production of liquid hydrocarbons, thousand BOE per day	1 049	1 058	1 046	1 074	1 098	1 055	1 064
Natural gas production, thousand BOE per day	779	805	855	811	883	889	883
Total hydrocarbon production, thousand BOE per day	1 828	1 863	1 902	1 885	1 981	1 944	1 947
Proved reserves of liquid hydrocarbons, million BOE	5 135	5 139	5 090	5 302	5 297	5 406	5 462
Proved reserves of natural gas, million BOE	7 123	7 215	7 247	7 376	7 533	7 722	7 710
Total proved reserves of hydrocarbons, million BOE	12 258	12 354	12 337	12 678	12 830	13 129	13 172
Proved reserves life of liquid hydrocarbons, years	13.38	13.37	13.65	14.45	13.95	15.1	14.9
Proved reserves life of natural gas, years	16.88	16.58	16.03	15.85	14.68	13.85	15.19
Proved reserves life of hydrocarbons, years	14.47	14.27	14.37	15.01	14.37	15.31	15.24

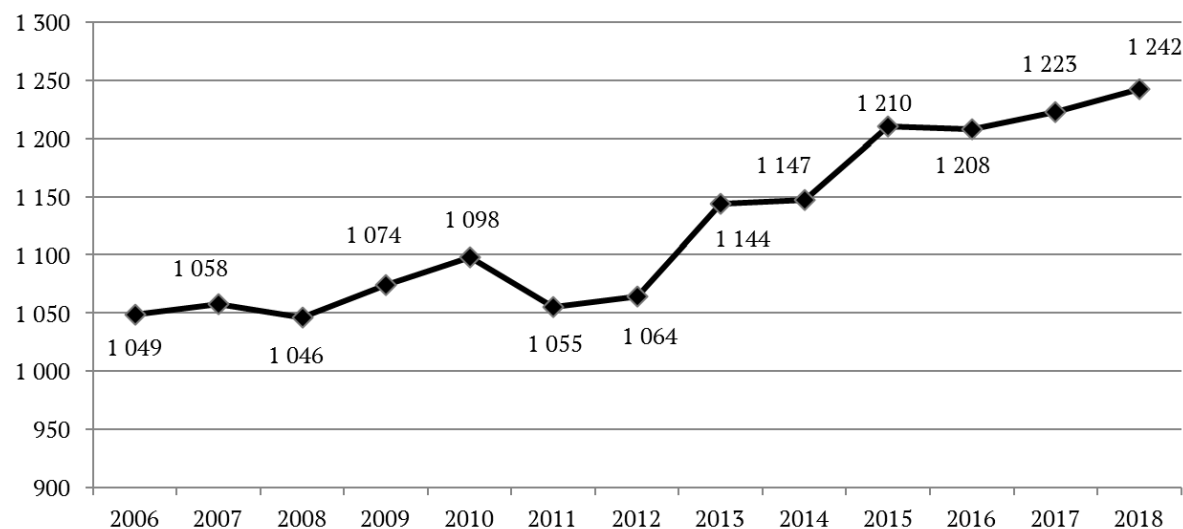
Continuation of the table

Indicator	2013	2014	2015	2016	2017	2018
Production of liquid hydrocarbons, thousand BOE per day	1 144	1 147	1 210	1 208	1 223	1 242
Natural gas production, thousand BOE per day	898	870	850	894	949	981
Total hydrocarbon production, thousand BOE per day	2 042	2 018	2 060	2 102	2 172	2 223
Proved reserves of liquid hydrocarbons, million BOE	6 089	6 085	5 817	5 550	5 742	6 123
Proved reserves of natural gas, million BOE	7 786	7 759	7 620	8 044	7 969	7 868
Total proved reserves of hydrocarbons, million BOE	13 875	13 844	13 436	13 593	13 710	13 991
Proved reserves life of liquid hydrocarbons, years	15.15	15	13.15	11.87	12.23	12.95
Proved reserves life of natural gas, years	14.48	14.55	14.36	13.58	13.84	13.09
Proved reserves life of hydrocarbons, years	15.5	15.63	14.08	12.96	13.08	13.5

Source: [32]

Figure 1

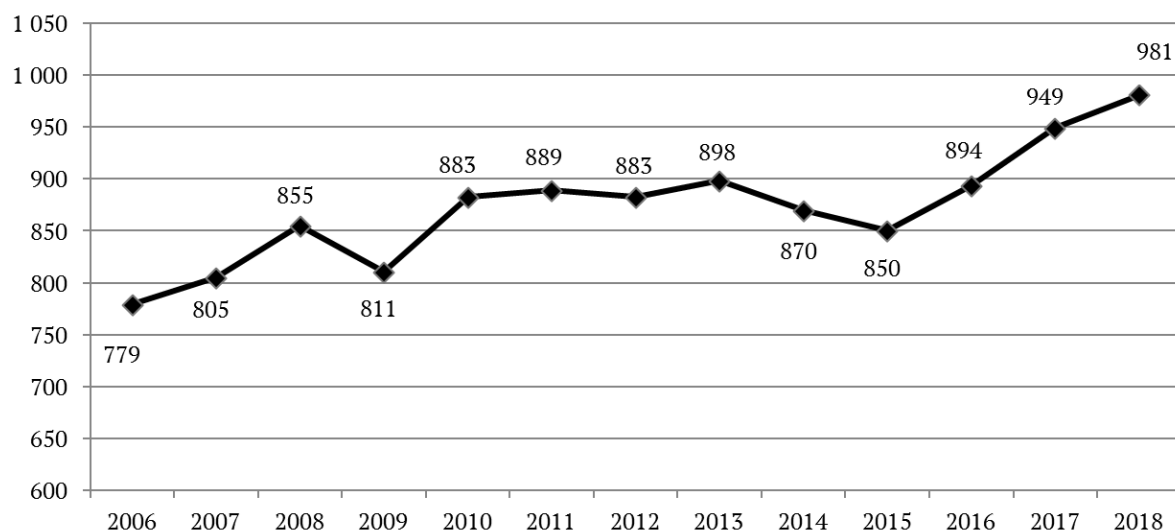
The average values of liquid hydrocarbon production of the twenty five leading public oil and gas corporations for 2006–2018, thousand barrel of oil equivalent (BOE) per day



Source: Authoring, based on Table 2 data

Figure 2

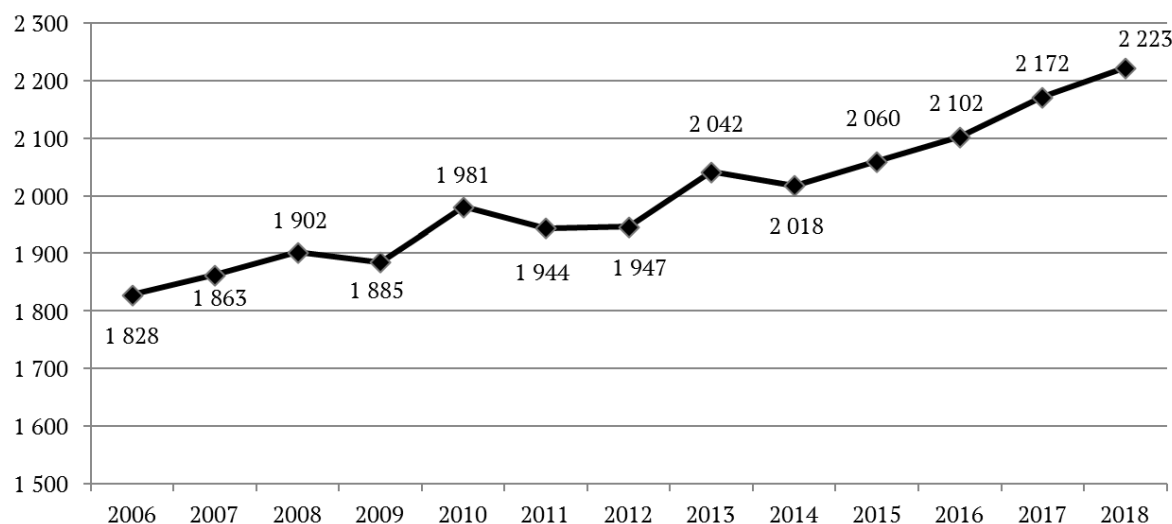
The average values of natural gas production of the twenty five leading public oil and gas corporations for 2006–2018, thousand barrel of oil equivalent (BOE) per day



Source: Authoring, based on Table 2 data

Figure 3

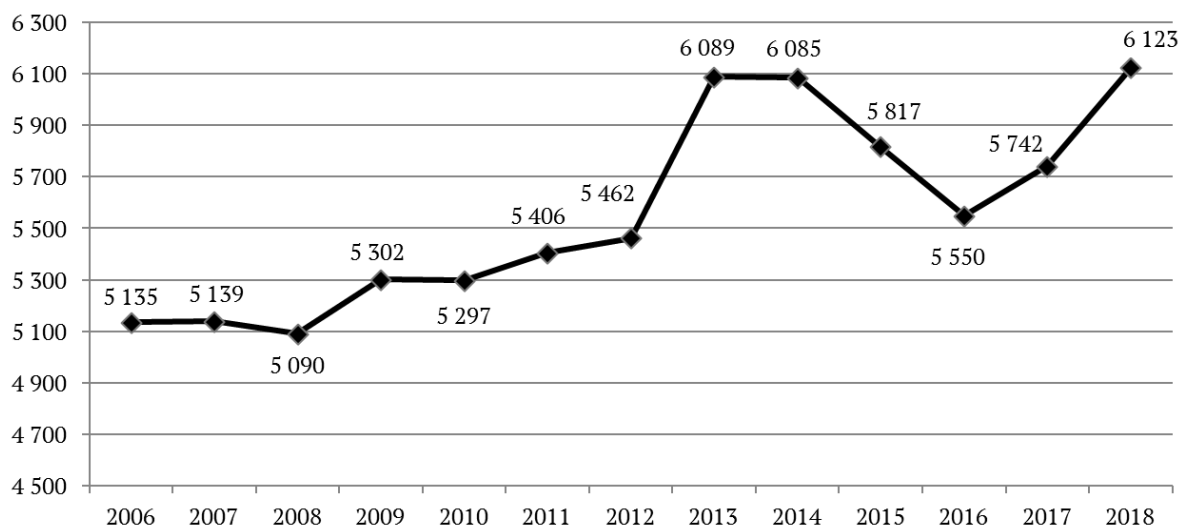
The average values of total hydrocarbon production of the twenty five leading public oil and gas corporations for 2006–2018, thousand barrel of oil equivalent (BOE) per day



Source: Authoring, based on Table 2 data

Figure 4

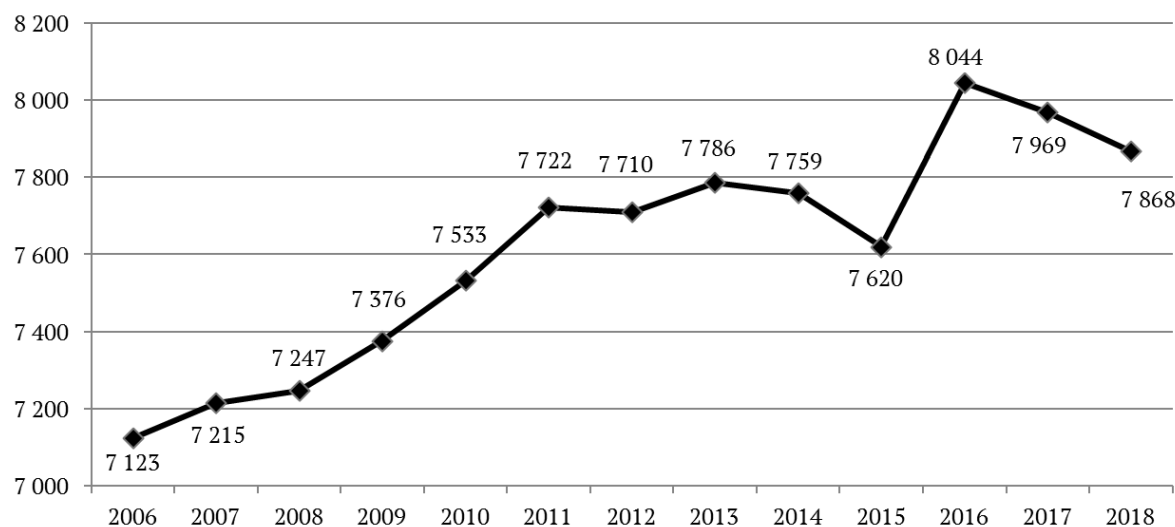
The average values of proved reserves of liquid hydrocarbons of the twenty five leading public oil and gas corporations for 2006–2018, million barrel of oil equivalent (BOE)



Source: Authoring, based on Table 2 data

Figure 5

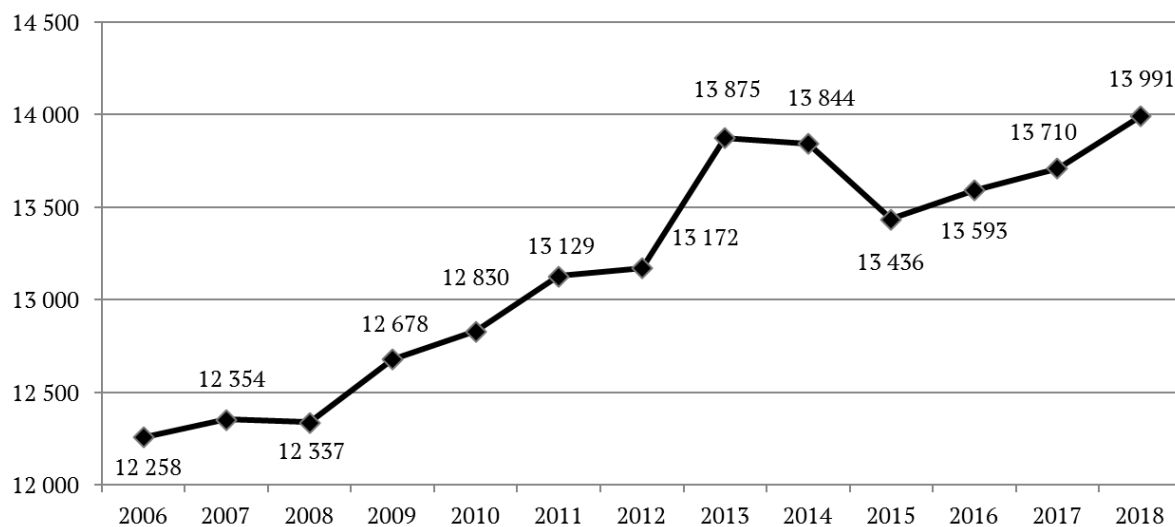
The average values of proved reserves of natural gas of the twenty five leading public oil and gas corporations for 2006–2018, million barrel of oil equivalent (BOE)



Source: Authoring, based on Table 2 data

Figure 6

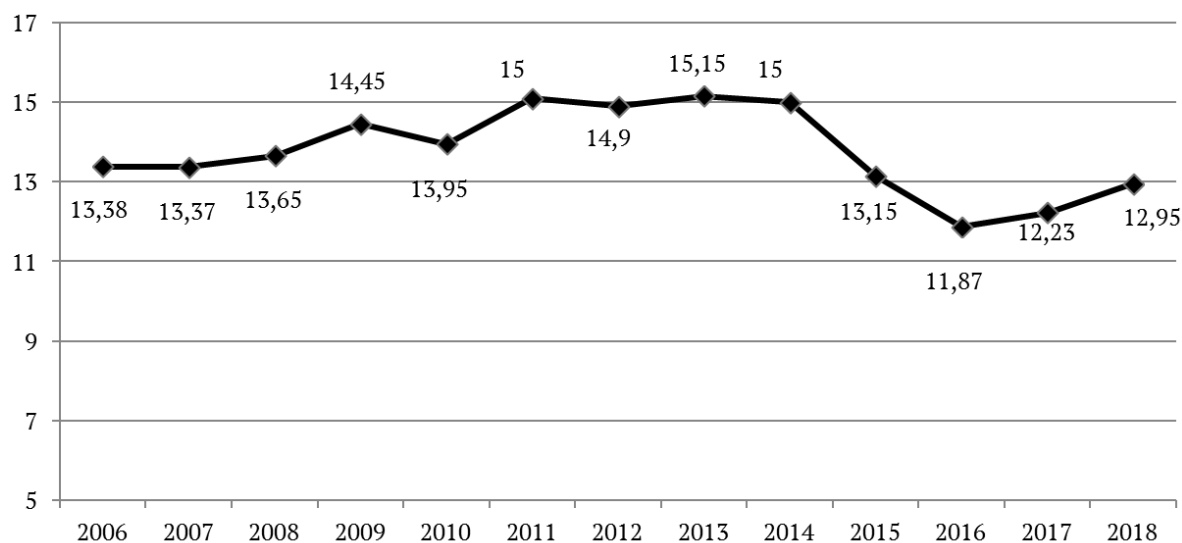
The average values of total proved hydrocarbon reserves of the twenty five leading public oil and gas corporations for 2006–2018, million barrel of oil equivalent (BOE)



Source: Authoring, based on Table 2 data

Figure 7

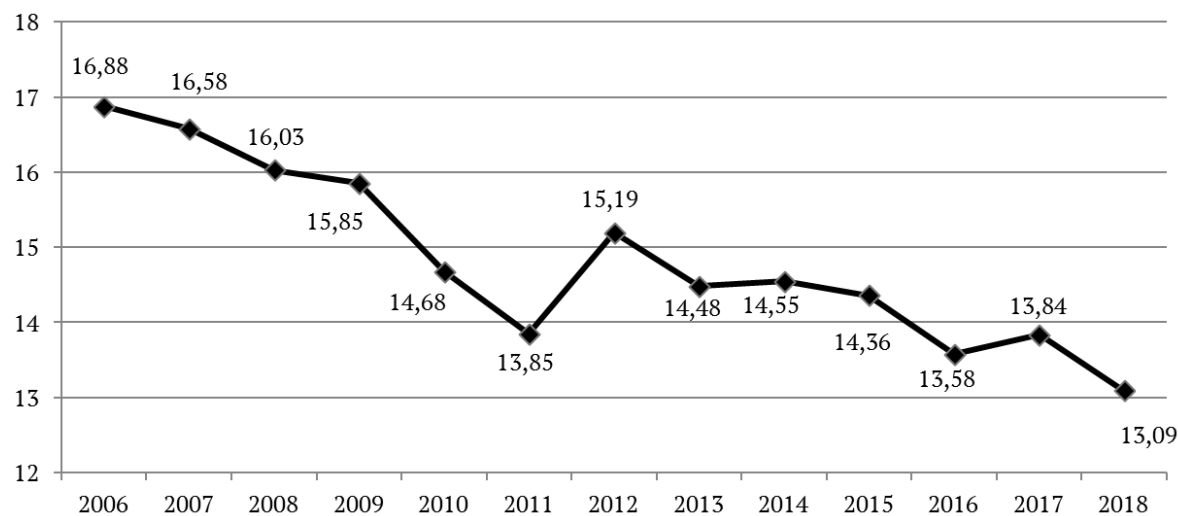
The average values of liquid hydrocarbons proved reserve life of the twenty five leading public oil and gas corporations for 2006–2018, number of years



Source: Authoring, based on Table 2 data

Figure 8

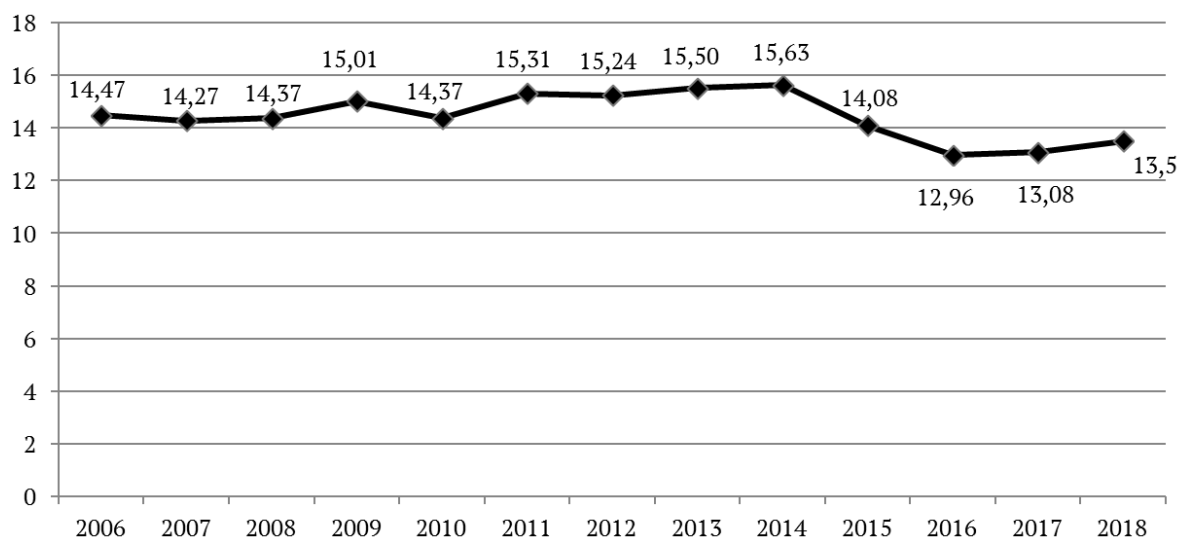
The average values of natural gas proved reserve life of the twenty five leading public oil and gas corporations for 2006–2018, number of years



Source: Authoring, based on Table 2 data

Figure 9

The average values of total hydrocarbon proved reserve life of the twenty five leading public oil and gas corporations for 2006–2018, number of years



Source: Authoring, based on Table 2 data

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Conflict-of-interest notification

I, the author of this article, bindingly and explicitly declare of the partial and total lack of actual or potential conflict of interest with any other third party whatsoever, which may arise as a result of the publication of this article. This statement relates to the study, data collection and interpretation, writing and preparation of the article, and the decision to submit the manuscript for publication.