

## ANALYSIS OF THE DEMAND, SUPPLY, AND PRICES OF CRUDE OIL FOR THE PERIOD 2010 ÷ 2022

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**ABSTRACT.** The study presents world demand and supply of crude oil for the period 2010 ÷ 2022 and the forecast of the US Energy Information Administration (U.S. EIA) for 2023 and 2024. World proven crude oil reserves at the end of 2021 are presented according to data by OPEC. The change in average annual crude oil prices for the period 2004 ÷ 2022 and in the average monthly prices for the period January 2004 ÷ April 2022, according to OPEC and U.S. EIA, are also analysed. The US Energy Information Administration's long-term forecast for the world consumption and for the change in crude oil prices by 2050 is presented. Key factors influencing crude oil demand, supply, and prices are outlined.

**Key words:** world demand and supply of crude oil; crude oil prices; key factors influencing crude oil prices.

### АНАЛИЗ НА ТЪРСЕНЕТО, ПРЕДЛАГАНЕТО И ЦЕНИТЕ НА СУРОВ ПЕТРОЛ ЗА ПЕРИОДА 2010 ÷ 2022 Г.

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**РЕЗЮМЕ.** В доклада е представено световно търсене и предлагане на суров петрол за периода 2010 ÷ 2022 г. и прогноза на Американската информационна администрация по енергетика за 2023 и 2024 г. Представени са доказаните геоложки запаси от суров петрол към края на 2021 г. по данни на ОПЕК. Анализирани са изменението на средногодишните цени на суровия петрол за периода 2010 ÷ 2022 г. и на средномесечните цени по данни на ОПЕК за периода Януари 2010 ÷ Април 2022 г. Представена е дългосрочната прогноза на американската информационна агенция по енергетика за световното потребление и изменението на цените на суровия петрол до 2050 г. Изведени са основните фактори, оказващи влияние върху търсенето, предлагането и цените на суровия петрол.

**Ключови думи:** световно търсене и предлагане на суров петрол; цени на суровия петрол; ключови фактори, влияещи върху цените на суровия петрол.

## Introduction

Forecasting crude oil demand, supply, and prices is an important factor in the development of national, community, and world economic systems. Numerous global, national, and industry agencies, banks, and organisations around the world prepare and periodically update their medium-term, long-term, and ultra-long-term forecasts concerning the production, consumption, and prices of this extremely important raw material in highly dynamic market conditions as a result of a highly dynamic economic and political situation.

The purpose of this paper is to analyse the accumulated historical information in order to reveal the factors and trends for the future development of demand, supply, and prices of crude oil worldwide.

### Global oil demand and supply

There are two best renowned institutions that prepare and update their forecasts concerning global production and consumption, as well as prices of energy sources, and in

particular of crude oil, namely: the U.S. Energy Information Administration (U.S. EIA) and the global International Energy Agency (IEA), which currently has 31 members, 11 associated countries, and 4 countries in the process of accession. Unfortunately, Bulgaria is not among them.

Figure 1 shows changes in the global production and consumption of crude oil for the period 2010 ÷ 2022 and the forecasts of the Organisation of Petroleum Exporting Countries (OPEC) for 2023 and 2024. The figure is based on OPEC data (OPEC, 2023).

The data presented in Figure 1 show that the demand and supply of crude oil fell sharply in 2020 due to the outbreak of the Covid-19 pandemic and the almost complete shutdown of the transport sector. In 2021, supply and demand grew rapidly and in 2023, they are expected to exceed 2019 levels.

According to OPEC data, the organisation's oil production in 2021 amounted to 31.6 mb/d. Global oil production was 95.2 mb/d. This means that OPEC member countries produced about 33.19% of global production.

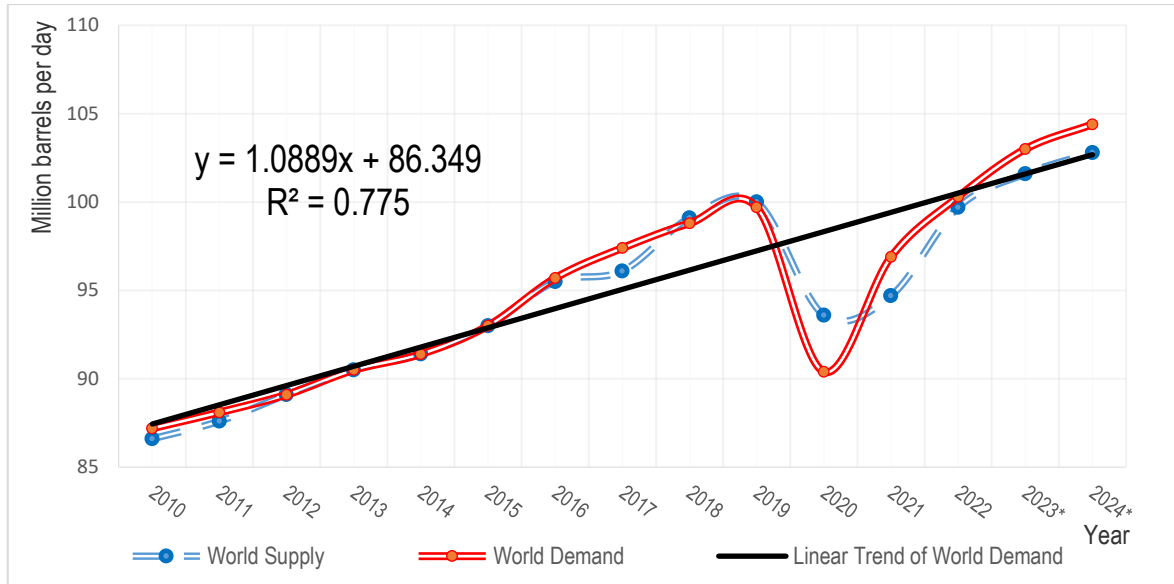


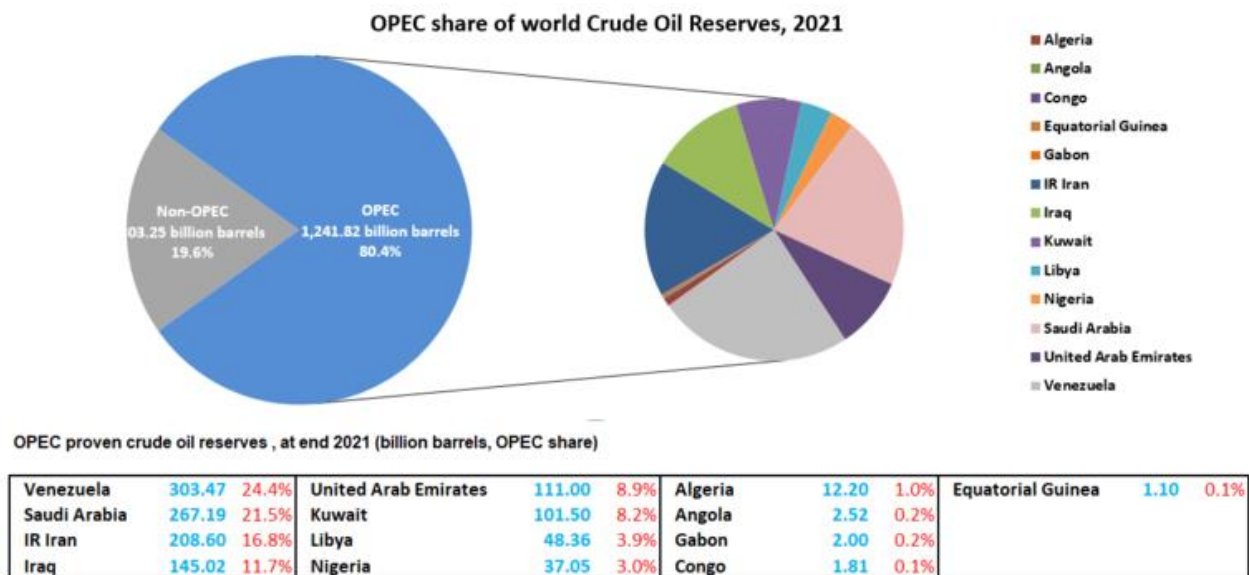
Fig. 1. World production and world consumption of crude oil and other liquids per day for the period 2010 ÷ 2022 and projection for 2023 and 2024.

The OPEC forecast for 2023 and 2024 shows an increase in oil production to levels of 101.6 mb/d in 2023 and 102.8 mb/d in 2024, which is about 1.18% CAGR of production.

The derived linear trend of world demand shown in Figure 1 is growing during the analysed period and is characterised by a high coefficient of determination of 0.775 and a corresponding correlation coefficient of 0.8803.

### Proved geological reserves of crude oil

According to OPEC data, at the end of 2017, nearly 81.89% of all proved geological reserves of crude oil in the world were located in deposits on the territory of OPEC member countries. The data for the end of 2021 are shown in Figure 2.



Source: OPEC, (2023). Annual Statistical Bulletin 2022.

Fig. 2. OPEC share of world crude oil reserves, at the end of 2021.

As of the end of 2021, OPEC countries held about 80.4% of the world's proved geological reserves, with approximately 67.1% of them located in the Persian Gulf region.

The proved reserves of crude oil at the end of 2021 were estimated at 1545 billion barrels, which, at the existing global consumption rate, will be enough for about 42.3 years. The most significant reserves are: Venezuela – 303.47 billion barrels (24.4%), Saudi Arabia – 267.19 billion barrels (21.5%), Iran –

208.60 billion barrels (16.8%), Iraq – 145.02 billion barrels (11.7%), UAE 101.50 billion barrels (8.2%), Kuwait – 101.5 billion barrels (8.2%), etc., as shown in Figure 2.

It is an interesting fact that in the past 60 years, the proved reserves of crude oil in the world have tripled despite the increased production. This is due to the significant amount of geological exploration activities, as a result of which new deposits of this valuable raw material are constantly being discovered and proved.

## Analysis of the changes in crude oil prices

The price of crude oil depends on both its quality and its location, and of course on a whole complex of geopolitical, economic, and market factors. Periodic cartel agreements between OPEC members and Russia also have a significant impact on the price. The purpose of these agreements is to limit oil production in order to raise its price. It should be pointed out that the price of oil has shown significant dynamics within the past and the current century.

Figure 3 shows the changes in the average annual prices of crude oil for the period 2004 ÷ 2023 as of January 1 of the respective year. Figure 3 is based on OPEC data (OPEC Backed Yearly Price, 2023).

The data in Figure 3 shows that the annual prices of crude oil in the period 2004 ÷ 2021 are characterised by extremely high dynamics.

As a result of the 2008 ÷ 2009 global financial and economic crisis, oil prices skyrocketed reaching a record high of US\$131.22 per barrel in July 2008. Periods of decline and rise

followed. As of February 2016, a 30-year low of US\$29.61 per barrel was reported. On April 22, 2020, the price of American light crude oil West Texas Intermediate (WTI) with delivery in May even fell to minus 37.63 US\$/b on commodity exchanges due to the lack of free storage volumes. Since then, the price of oil has risen sharply and in April 2023 it exceeded 80 US\$/b.

Disrupted supplies of natural gas from Russia to Europe after the hostilities in Ukraine have raised the price not only of oil, but also of natural gas.

The price of oil has a significant impact on the price of natural gas in Bulgaria, albeit with a delay of several months. The reason is the formula used to determine the price of natural gas, which takes into account the prices of all alternative fuels. It is also a fact that over the past year, the situation on the gas market has changed abruptly. Additional sources are now available, not just so-called "pipeline" gas, and this is forcing producers to gradually comply with customers' demands.

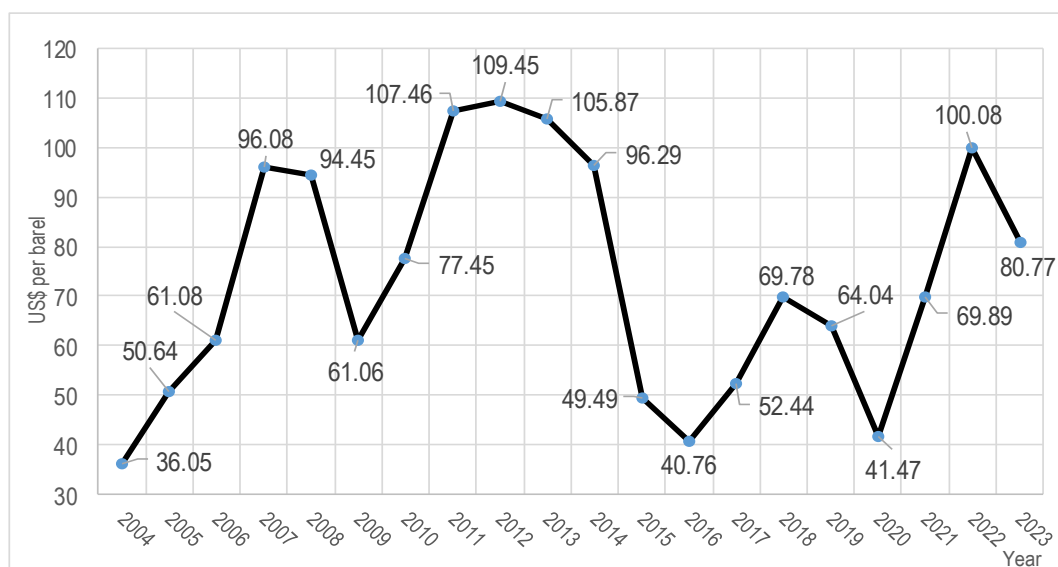


Fig. 3. Annual crude oil prices for the period 2004 – 2023, as of 01 January of the year

The World Trade Organization (WTO) and the European Union cooperate on a global scale to reduce trade barriers by reducing tariffs, fees, and other restrictions, harmonising trade rules by implementing international standards, overcoming conflicts of interest by creating mutually beneficial trading conditions. The main activity of the WTO is based on open trade, which is based on commercial interests. The policy of the European Union is aimed at diversifying the sources of natural gas and oil and encouraging free competition.

Crude oil, natural gas, and coal are of strategic importance for the global energy balance, the exploration and exploitation of which require significant investment, operational and transport costs. Over the past 10 years, total oil consumption has increased by more than 15%. It is largest in developed industrial countries, such as the USA, China, Japan, Germany, France, and Italy. Studies that were conducted have shown that with an increase in economic activity in the world by 1%, the global consumption of energy carriers rises by an average of 0.5%. It is expected that in 2030, the quality of life of about 80%

of the planet's population will depend heavily on the energy resources used.

The global demand and supply of energy carriers mainly depends on the development of the world economy, the growth rates of individual sectors, the increase in the number of the planet's population, the increase in explored and proved geological reserves, and the mining capacities and transport facilities built in different countries. A slowdown in Chinese economy, which produces about 30% of the world's output, predetermines a contraction in the consumption of energy carriers. The main indicator of the world economy being provided with sufficient energy raw materials is the ratio between the amount of proved geological reserves and the level of their extraction. As mentioned before, proved geological reserves are increasing annually, and the expected contraction of global production in 2023 shall lead to an increase in the supply of crude oil. This predetermines a natural drop in the price of oil.

Global oil trade covers export and import both worldwide and within individual regions and countries. The state of the world markets is mainly determined by the influence of a number of economic and political factors. The largest exporters in terms of value in 2023 are again the countries of the Persian Gulf and Russia. The International Energy Agency (IEA) projects global consumption of oil and other liquid fuels to range from 103 million barrels per day in 2023 to 105 mb/d in 2030 and around 125 mb/d in 2040.

In its 2023 annual report, the U.S. The Energy Information Administration (U.S. EIA, 2023) projects the change in crude oil prices in nominal dollars per barrel over the next 26 years to vary within the ranges shown in Figure 4.

It should be noted in Figure 4 the extremely wide interval since 2023 between pessimistic and optimistic forecast for the change in Brent crude oil prices.

According to the IEA (U.S. EIA, 2023), strategic development will focus on solving the following priority tasks:

- development of new oil and gas fields, necessary to ensure the ever-growing needs of energy raw materials;

- construction of new oil and gas pipelines to deliver energy raw materials to consumers;
- expanding international cooperation in view of attracting the necessary high-capital investment;
- improvement of mining and processing technologies with a view to improving economic and environmental efficiency;
- developing long-lasting and mutually beneficial relations between the countries producing energy resources and the countries consuming them;
- stabilisation of the international markets of energy raw materials with a view to guaranteeing global consumption;
- activation of interaction in ensuring the necessary safety of energy facilities;
- coordinating efforts and actions to overcome possible energy crises in the world economy, etc.

If oil prices rise, this will activate projects with a higher cost of extraction and processing of energy raw materials, which are not cost-effective at low prices.

All cartels succeed in raising crude oil prices, but only in the short term. In the medium and longer term, this could hardly be possible, and is not profitable for OPEC.

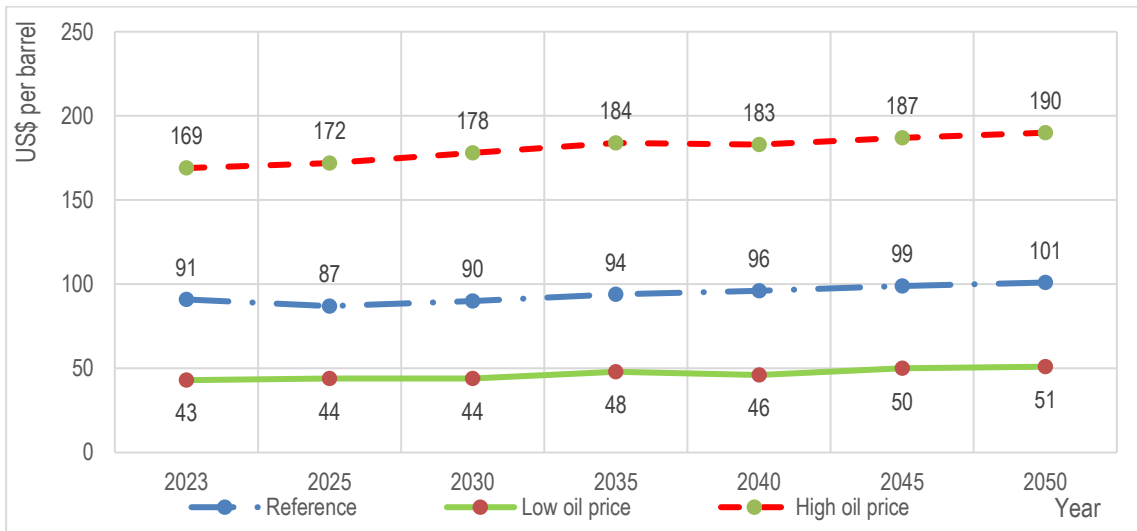


Fig. 4. Projection crude oil prices according to OPEC, (2023). 2022 World Oil Outlook 2045

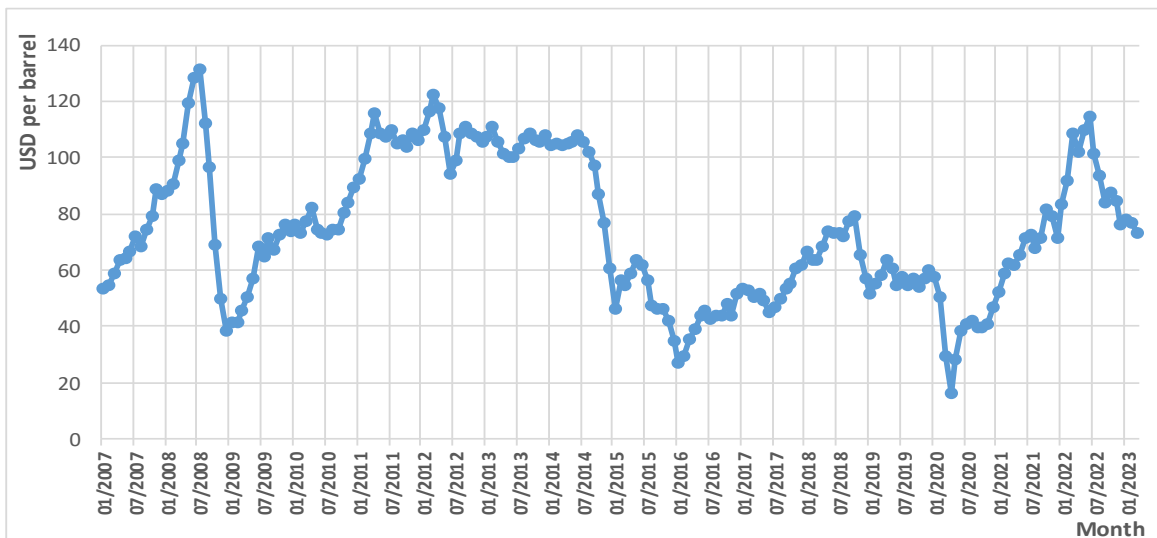


Fig. 5. Average monthly crude oil prices according to OPEC data for January 2007 ÷ March 2023.

Figure 5 shows the change in the average monthly prices of crude oil for the period January 2007 ÷ March 2019. The figure is based on OPEC data (OPEC Backed Monthly Price, 2023).

According to Mitev (2017, 2019), “the major factors affecting demand, supply, and prices of crude oil are extremely diverse. In the long term, oil prices are influenced by the following factors: the economic growth of the global economy; population growth; the change of proven geological reserves; international and regional military and political conflicts; OPEC production regulations and the cartel agreements to limit mining and to impose extraction quotas for member states over certain periods of time; the security of crude oil supplies for oil refineries; the imposing of an embargo and of import and export restrictions; climatic cataclysms; the effect of seasonality; the imposing of import duties and the like; world production and consumption of oil; market speculations; exchange rate fluctuations; intense competition, etc.”.

## Conclusion

Demand for crude oil in the period 2010 ÷ 2022 increased by 15.0%, from 86.6 mb/d in 2010 to 99.7 mb/d in 2022. The situation with supply is similar.

The forecast of the U.S. IEA for 2023 and 2024 is for oil demand and supply to increase to levels of 104.4 mb/d by 2024, which is about 2.04% average annual production growth.

The average annual prices of crude oil during the 2004-2023 period are characterized by extremely high dynamics, mainly influenced by temporary surpluses or deficits of the volumes of commodity stocks, but also by local political or military conflicts, as well as economic crises. We also witnessed the first pandemic crisis and its negative effects.

If oil prices rise in the short term, this could boost shale production and other producers to gain market share at the expense of OPEC. This would again put downward pressure on prices due to the inclusion of less cost-effective production facilities and mining sites.

In the long term, global demand, supply, and prices of energy carriers highly depend on the growth rates of the world economy and individual sectors of the global economy, the growth of the planet's population, the geo-economic and geo-political situation, the volumes of explored and proved geological reserves, the mining, transport and processing capacities built in the various regions, and not so much on cartel agreements, which have a rather short-term effect.

Past practice has shown that no matter how well-founded the forecasts of the various international agencies and organizations are regarding the demand, supply and prices of the main energy sources, they have a high degree of uncertainty and need to be updated every three to six months.

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