

Review paper

OIL AND NATURAL GAS PRICE DYNAMICS IN THE 21ST CENTURY: A REVIEW OF KEY FACTORS AND EVENTS

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Received: June 23, 2026

Accepted: June 29, 2026

Abstract: This paper analyzes key factors and events in the 21st century that have determined the dynamics of crude oil and natural gas prices on the global market. Particular emphasis is placed on geopolitical and macroeconomic factors that have influenced shifts in supply-demand balance, as well as the emergence of increased volatility in energy markets. The study examines the Iraq War and the U.S. military intervention, the Arab Spring, the COVID-19 pandemic, the Russia-Ukraine war, and contemporary tensions between the United States, Israel, and Iran. These events, through disruptions in production, transportation, and global energy flows, have significantly affected price formation and market structures in both oil and natural gas markets. The results indicate that geopolitical and structural factors play a dominant role in shaping both short-term volatility and long-term trends in energy markets, with their effects directly reflected in global economic stability and energy security.

Keywords: crude oil, natural gas, energy markets, price volatility, geopolitical risk, global economy

1 INTRODUCTION

Oil and natural gas are among the most important energy resources of modern society, and their market prices have a significant impact on the global economy, energy security, and industrial development. Throughout more than 160 years of commercial exploitation, the prices of these strategic mineral resources have been subject to numerous fluctuations, manifested through periods of sharp increases and significant declines.

Changes in oil and natural gas market prices result from the complex interaction of various economic and non-economic factors. Among the most important are supply and demand, geological and geographical conditions, geopolitical circumstances, and technological development. Although all these factors influence price formation, their impacts are not equally significant. Previous studies have shown that the most

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pronounced price fluctuations are often associated with geopolitical events, political instability, and international conflicts.

Due to the interdependence of these factors, a change in one of them can trigger chain reactions affecting the entire market. Leading oil and gas producers and exporters, as well as international organizations, play a particularly important role in price formation, as their decisions can significantly influence global supply and demand.

Throughout the history of the oil and gas industry, numerous events have caused substantial changes in market prices. These fluctuations have been particularly pronounced in the oil market, whereas natural gas prices, although often linked to oil price movements, have generally exhibited a lower degree of variability. This paper analyzes the most significant changes in oil and natural gas prices during the 21st century, with particular emphasis on the factors and events that have shaped their development.

2 KEY FACTORS INFLUENCING OIL AND GAS PRICES

Oil continues to play an important role in the global economy, despite ongoing efforts to reduce its use and to find alternative energy sources. There are several factors that influence crude oil prices. They can be divided into external factors (general economic, political, geological, and market-related) and technological factors.

The most important factors include the current state of supply and demand, the condition and growth rate of the global economy, technological and technical progress (new technologies, materials, communication systems, alternative energy sources, etc.), the state and discovery of proven and potential oil reserves, as well as production costs (Miao et al., 2017).

The most significant non-economic factors include global military and political relations, strikes at production facilities and primary processing plants for mineral resources, port workers' strikes, and various forms of social unrest. Additional factors include upcoming labor contract negotiations in major producing countries, the imposition of embargoes on mineral resource imports from certain countries, the impact of natural conditions, local conflicts and open wars, partial or complete nationalizations, as well as policies related to the creation, replenishment, and sale of strategic reserves (stocks). Restrictive and protectionist policies, along with environmental protection and conservation measures related to human living and working conditions, also play an important role (Janković and Milovanović, 1985).

2.1 Supply and demand factor

Oil and natural gas prices are influenced by a wide range of factors, with the fundamental economic principles of supply and demand being particularly important. According to this relationship, an increase in supply leads to lower prices, while an increase in demand

leads to higher prices. Demand for oil depends on industrial production, economic growth, transportation, seasonal changes, and population growth, while on the supply side OPEC has traditionally played a key role through production control, and the United States increasingly contributes to global supply due to shale oil production (Pirog, 2005). In the case of natural gas, storage levels significantly affect supply stability by smoothing seasonal demand fluctuations, with inventories typically increasing from April to October (EIA, 2021). In addition, extreme weather conditions such as hurricanes and cold waves can disrupt production and supply chains, which under high demand conditions may lead to sharp price increases (Pirog, 2005; EIA, 2021).

2.2 Geological and geographical factors

Geological factors play an important role as they determine the presence of oil- and gas-bearing basins in different regions of the world. In addition, geographic location and reservoir accessibility influence transportation costs, which account for approximately one-fifth of the total oil price; therefore, location represents a key factor in price formation. The largest oil and gas reserves are found in countries such as Venezuela, Saudi Arabia, Canada, Iran, Iraq, Kuwait, the United Arab Emirates, Russia, Libya, and the United States (Fig. 1), with a significant share of these reserves concentrated in the Middle East and North Africa region, and more than half of the leading countries being OPEC members (Killian, 2009).

In addition to geological and geographical conditions, oil prices also depend on the quality of crude oil, which varies according to density and sulfur content, affecting its suitability for refining. Consequently, different benchmark crude oils are used as global price standards, such as Brent, West Texas Intermediate (WTI), and Dubai crude, as well as regional benchmarks including Urals, Bonny Light, Tapis, Duri, Isthmus, and Western Canadian Select (Gomez and Moya, 2020; Kostić, 2020).

Transport also plays a significant role in price formation, as the global pricing structure is partly based on the distance between producers and consumers, but also includes additional costs such as passage through maritime routes and transit channels, as well as risks associated with weather conditions, delays, and political instability (Melamid, 1962).



Figure 1 Geographical location of countries with the largest oil reserves (Desjardins, 2019).

2.3 Geopolitical factors

Countries with large oil production, such as the United States, Venezuela, Canada, Saudi Arabia, Iran, and Iraq, significantly determine market supply, and tensions involving any of these nations can lead to major disruptions. A similar situation applies to natural gas, where countries with the largest reserves include Russia, Iran, and Qatar. As a result, if war or conflict occurs in oil- and gas-producing regions, or if such events are anticipated, supply may be threatened, ultimately leading to price changes. Therefore, geopolitics has traditionally been an important factor influencing oil and gas prices (Hughes & Long, 2015; Zhao et al., 2023)

2.4 Technological and technical factors

Technological and technical progress reduces the costs of oil exploration, production, transportation, and storage, which leads to a decrease in crude oil prices. Innovations in geological exploration (remote sensing, geophysics, mathematical simulation, geothermal modeling), as well as in oil production (horizontal and directional drilling, new offshore platform designs, and faster production rates), have contributed to lower costs and, consequently, reduced oil prices (Deku and Lim, 2024).

3 KEY EVENTS AFFECTING OIL AND GAS PRICES IN THE 21ST CENTURY

Throughout the 21st century, a number of key geopolitical and economic events have significantly influenced the price dynamics of oil and natural gas. Among the most important are the military intervention of the United States and the United Kingdom in Iraq, the Arab Spring, the COVID-19 pandemic, the armed conflict between Russia and Ukraine, as well as the escalation of tensions and armed conflicts between the United States, Israel, and Iran. All of these events have led to disruptions in global supply and energy security, which has directly affected the volatility of energy prices on the world market.

3.1 Military intervention of the United States and the United Kingdom in Iraq

The Iraq War, also known as the Second Gulf War, was a conflict conducted in two phases. The first phase was a short, conventional war in March-April 2003, during which combined forces from the United States and the United Kingdom (with smaller contingents from several other countries) invaded Iraq and rapidly defeated Iraqi military and paramilitary forces. This was followed by a longer second phase in which U.S. forces occupied Iraq. Following the stabilization of the situation in the country in 2007, the United States gradually reduced its military presence in Iraq and formally completed its withdrawal in December 2011.

The military intervention in Iraq led to a significant disruption in Iraqi oil production, with a maximum lost production capacity of approximately 2.4×10^6 bbl/day, while the average production loss in 2003 amounted to about 1.4×10^6 bbl/day. Three wars and decades of instability severely damaged the country's oil industry, and production did not fully recover until the beginning of 2008 (McNally, 2017).

Iraq has approximately 3.7×10^9 m³ of proven natural gas reserves, accounting for about 2% of global reserves and ranking 12th in the world. Its proven reserves are around 1,194 times higher than annual consumption. Although Iraq's gas basins are significant, due to underdeveloped infrastructure, about one-third of the produced gas (associated gas from oil production) is flared, limiting both exports and domestic supply. During periods of war and sanctions, exports of oil and gas were disrupted, which led to an increase in prices from approximately 0.90 USD/m³ in 2000 to 1.26 USD/m³ in 2003, reaching a peak of 2.60 USD/m³ in 2008, followed by a decline to about 1.10 USD/m³ in 2009 (McNally, 2017).

3.2 „The Arab Spring“

“The Arab Spring” refers to a series of pro-democracy protests that, since 2011, spread across several predominantly Muslim countries, including Tunisia, Egypt, Libya, Syria, and Bahrain, with long-term political and social consequences. Although in some cases they led to regime changes (Tunisia, Egypt), in many countries they resulted in increased instability. In Libya, a disruption of approximately 1.5×10^6 bbl/day in oil supply to the market occurred, contributing to oil prices rising above 100 USD/bbl, while during the period 2011–2014 prices ranged between 100 and 125 USD/bbl (McNally, 2017). In parallel, the civil war in Syria that followed the protests led to a prolonged political and humanitarian crisis and significant population migration flows. Prior to 2011, Syria produced around 400,000 bbl/day of oil (of which approximately 140,000 bbl/day were exported), while proven natural gas reserves were estimated at 8.5–9 trillion m³. Following the outbreak of the crisis, oil production fell to about 25,000 bbl/day, turning the country from a net exporter into a state dependent on imports and alternative supply routes, whereas natural gas production was less affected due to the need to maintain electricity supply under conflict conditions (Al-Ghazi, 2021).



Figure 2 Price trend chart 2000-2015 (Theanphibian, 2012)

Note. Data adapted from Theanphibian, 2012.

3.3 COVID-19 Pandemic

The COVID-19 pandemic led to one of the most pronounced disruptions in the modern oil market. After a period of relatively stable prices during 2018-early 2020, the decline in oil prices began due to disagreements between major OPEC producers and was subsequently intensified by the global COVID-19 pandemic and a collapse in demand. Due to mobility restrictions across many countries, oil consumption nearly came to a halt, while storage capacities reached maximum levels for the first time, resulting in

extreme market disruptions, including negative storage pricing conditions. During this period, production was temporarily reduced to approximately 12×10^6 bbl/day, while demand in April 2020 was about 29×10^6 bbl/day lower compared to the same month of the previous year, representing the lowest level since 1995 (Lahn & Bradley, 2020). Oil prices experienced a sharp decline in March 2020, with Brent crude reaching around 51 USD/bbl (Fig. 3), while Urals crude fell to 11–20 USD/bbl, reflecting a severe imbalance between global supply and demand in the oil market.

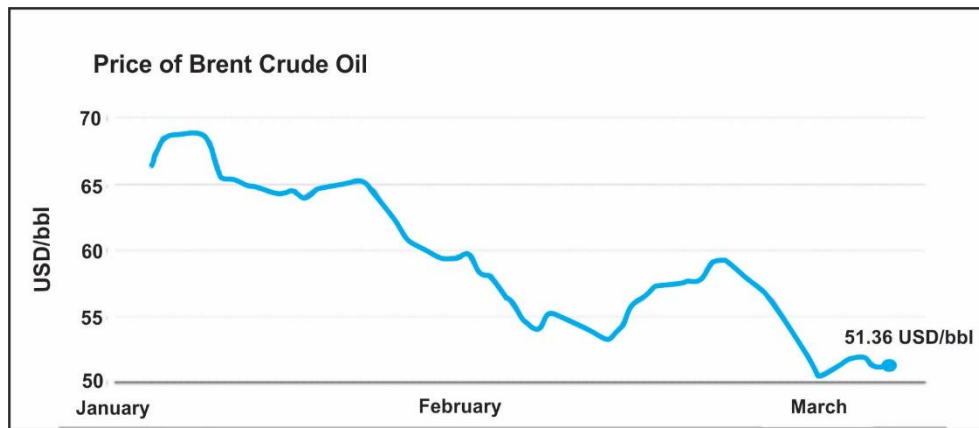


Figure 3 Chart of Brent crude oil price movements during January, February, and March 2020 (BBC, 2020).

Note. Adapted from BBC News (2020).

3.4 Russia-Ukraine conflict

The Russian military intervention in Ukraine in 2022 caused significant disruptions to the global oil and natural gas markets, leading to a major restructuring of trade flows and supply routes. As a result of Western sanctions and reduced exports to Europe, Russia increasingly redirected its oil exports toward Asian markets, particularly China and India, often at substantial discounts and using high-risk logistical solutions such as ship-to-ship transfers. At the same time, European refineries compensated for the loss of Russian crude oil by increasing imports from West Africa and the United States, with U.S. crude exports to Europe rising by more than 15% compared to March levels and reaching approximately 1.45 million bbl/day (Fattouh, 2022). These developments represent one of the most significant restructurings of global oil trade flows since the expansion of unconventional oil production in the United States. Despite the initial market disruptions and the surge in oil prices to over 139 USD/bbl in March 2022, prices gradually stabilized at around 110 USD/bbl in the following months, while the price of Urals crude averaged approximately 76 USD/bbl (Cahill, 2022). Russian exports

partially recovered to pre-conflict levels as early as April, despite the substantial changes in market structure.

From 2023 to 2026, the global oil and natural gas market continued to adjust to the consequences of the Russia-Ukraine conflict and the sanctions imposed on Russia. Although Russian oil export volumes remained relatively stable due to the redirection of flows toward China and India, export revenues declined because of lower selling prices and the implementation of price-cap mechanisms by Western countries (Babina et al., 2025; Johnson et al., 2023). During this period, Brent crude oil prices gradually stabilized, averaging approximately 82.5 USD/bbl in 2023, 80.5 USD/bbl in 2024, and around 69 USD/bbl in 2025, reflecting a combination of weaker global demand and relatively stable supply conditions (Fig. 4).

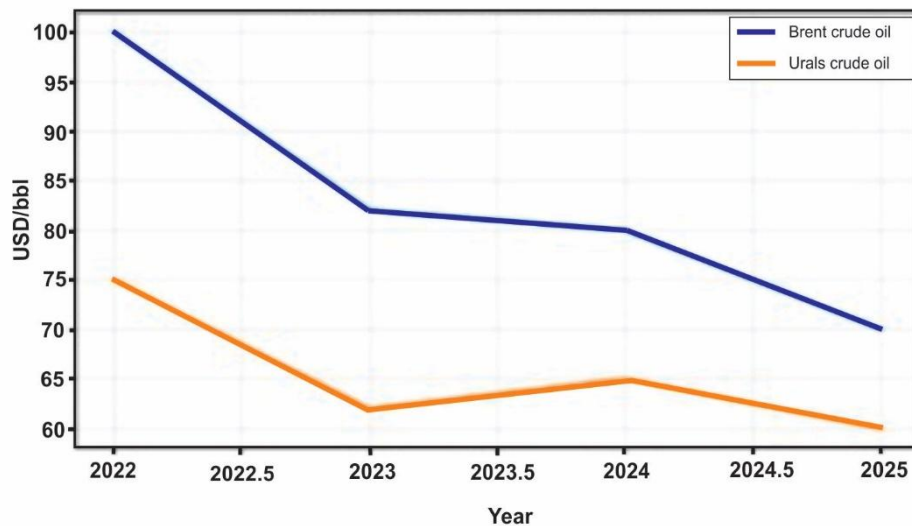


Figure 4 Brent vs Urals crude oil prices 2022-2025 (European Commission, 2025).

Note. Data adapted from European Commission (2025).

The natural gas market showed a higher degree of stabilization compared to the 2022 energy crisis, although it remained sensitive to geopolitical developments. The European TTF benchmark averaged about 37 EUR/MWh in 2024, increasing to approximately 42 EUR/MWh in 2025 (Fig. 5), corresponding to roughly 0.40–0.50 USD/m³ in energy-equivalent terms. At the same time, the European Union continued to diversify its energy supply through increased liquefied natural gas (LNG) imports, referring to natural gas that is cooled to approximately -162°C and transported in liquid form via specialized tankers before regasification and integration into the European gas network, as well as through alternative pipeline sources. This significantly reduced dependence on Russian natural gas and contributed to the gradual stabilization of the market. Nevertheless,

global energy markets remained influenced by geopolitical tensions and ongoing structural changes in trade flows (European Commission, 2025).

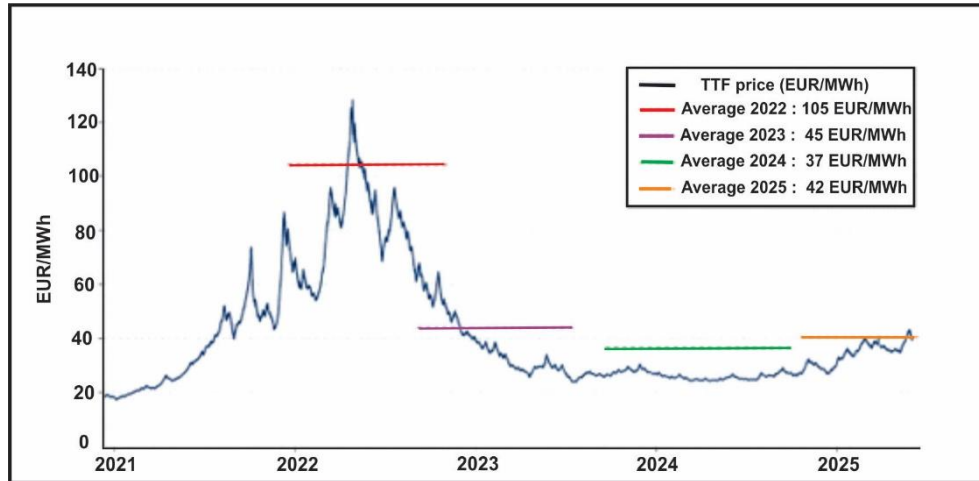


Figure 5 Evolution of European natural gas prices (TTF) during the Russia-Ukraine conflict 2022-2025 (European Commission, 2025).

Note. Data adapted from European Commission (2025).

3.5 US-Israel-Iran conflict

The escalation of the conflict between Iran, the United States, and Israel during 2026 led to a significant increase in geopolitical risk in global energy markets and pronounced volatility in oil prices. A particularly important factor is the potential disruption of transportation through the Strait of Hormuz, through which approximately 20% of global seaborne oil trade passes, making it a critical determinant of global supply conditions (Reuters, 2026a).

During periods of intensified conflict and restrictions on maritime traffic, Brent crude oil prices recorded a sharp increase from approximately 95-100 USD/bbl to levels above 110–120 USD/bbl while in phases of de-escalation and diplomatic progress prices declined below 90 USD/bbl, and in some instances toward 80 USD/bbl (Reuters, 2026b; Reuters, 2026c). These movements indicate a pronounced geopolitical risk premium embedded in oil prices (Fig. 6).

In periods of partial or perceived closure of the Strait of Hormuz, markets reacted with immediate price spikes due to expectations of reduced global supply and disruptions in supply chains. Conversely, announcements of de-escalation and progress in negotiations between the United States and Iran led to rapid downward corrections, confirming the high sensitivity of energy markets to geopolitical information (Reuters, 2026d).

Overall, the 2026 developments demonstrate that geopolitical factors, particularly the Iran-related conflict and the status of the Strait of Hormuz, were the dominant drivers of short-term movements in global oil prices.

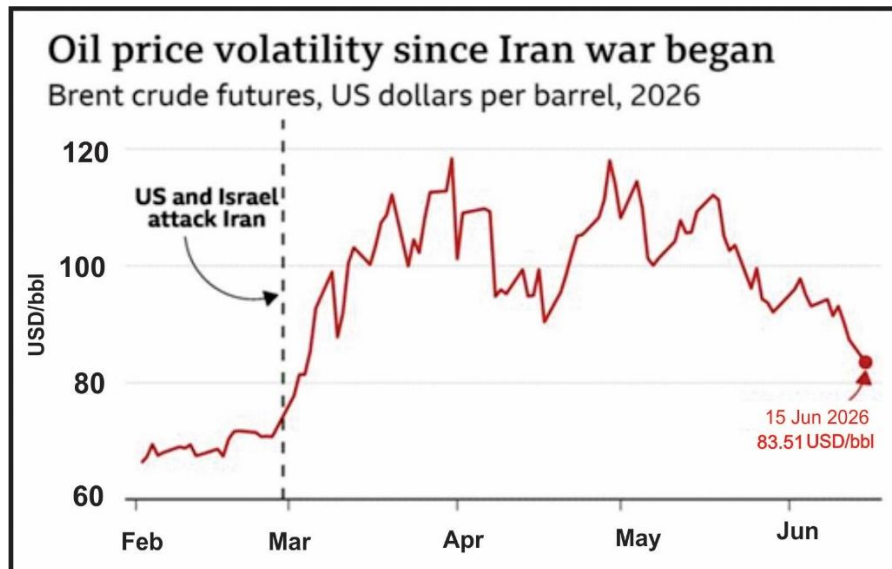


Figure 6 Brent crude oil price fluctuations during the US-Israel-Iran conflict (February-June 2026).

Note. Adapted from BBC News (2026).

4 CONCLUSION

In the 21st century, the dynamics of crude oil and natural gas prices have been driven by a complex interaction of fundamental market forces and recurrent geopolitical and macroeconomic disruptions. Conflicts in key producing regions, sanctions regimes, OPEC and OPEC+ production decisions, global financial crises, as well as disruptions in supply chains and strategic transport routes, have repeatedly resulted in pronounced volatility across global energy markets.

These developments have had significant implications for the global economy, given that oil and natural gas remain essential inputs for transportation, industrial production, electricity generation, and heating. Periods of sharp energy price increases have contributed to higher inflation, reduced real purchasing power, and slower economic growth, particularly in net energy-importing economies. Conversely, periods of declining prices have temporarily alleviated cost pressures but have also negatively affected fiscal stability and investment capacity in major exporting countries.

Overall, oil and natural gas price movements in the 21st century highlight the persistent vulnerability of the global economic system to energy supply disruptions and geopolitical risks. The increasing interconnectedness of global energy markets, combined with the continued structural dependence of modern economies on fossil fuels, confirms that energy commodities remain key determinants of industrial development, macroeconomic stability, and international economic relations.

Acknowledgment: The authors thank the Serbian Ministry of Education, Science, Technological Development and Innovation for their support and the funds provided under Contract No. 451-03-34/2026-03/200126.

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