



THE COMMERCE SOCIETY
SHRI RAM COLLEGE OF COMMERCE



THE TRANSFORMATION OF THE GLOBAL OIL INDUSTRY

Research Report 2024-25

RECOGNISED BY:





Testimonials

"The report well encapsulates the historical and the present developments around oil that still positions as one of the key engines of the global economy as efforts around renewable energy stand in the background."

- Mr. Anirban Dutta, Engagement Relations, The Geostrata

"It was a comprehensive report covering the changes in the energy scenario across the globe, since beginning till date. For the, it will serve as an excellent resource for getting acquainted with the ever-changing energy scenario around the world, along with the various reasons that drive them. It is apparent that in-depth research has been carried out while preparing this report. Further, this could serve as a prelude to further detailed reports with special focus on developing nations like India with the unique challenges it faces."

- Mr. Bikrom, Chief Manager, Indian Oil Corporation

"The report on The Transformation of the Global Oil Industry provides a timely and insightful overview of a sector undergoing rapid change. It effectively highlights the impact of technological advances, geopolitical shifts, and the global energy transition. Clear, well-researched, and forward-looking, this report is a valuable resource for understanding the past, present and future of the oil industry. I specifically liked the way it binds up with a story-telling approach complemented with artifacts."

- Dr. Vipulesh Shardeo, Professor, Fore School of Management

"In an industry where every barrel tells a story of power, policy, and progress, this report stands out as a thoughtful and timely narrative. The depth, clarity, and contextual richness of the analysis reflect not only a keen academic eye but a genuine curiosity for how the world moves often quite literally on energy. I would like to congratulate the Commerce Society of SRCC for taking on such a complex, global subject with maturity and insight. This work is more than just research; it is a story of an industry at a crossroads, told with passion and precision."

- Mr. Zeyaur Rahman, Sr. Officer (HR), GAIL (India) Limited.

"The report offers an exceptional distillation of a complex and far-reaching report on the transformation of the global oil industry. It captures the historical milestones, current environmental and geopolitical pressures, and the major shifts underway as the world moves toward cleaner energy. I especially appreciated how clearly the report outlined future trends, including the energy transition, economic diversification, and the growing importance of ESG standards. It's an insightful, well-structured overview that provides valuable clarity for anyone navigating or studying the energy sector."

- Mr. Avijit Mazumdar, Sr. Manager (Power & Utility), NRL



"The birth of the Global Oil & Gas industry, its growth and transformation is well captured. The report captures trends towards reduction in dependence upon fossil fuels and transition towards a Gas based economy and further focus towards Renewals. In the Indian context it is interesting to note that India has a current refining capacity of around 256 MMTPA and this is planned to continue to increase till 2040 to meet increasing demand. Further, more and more refiners are transitioning to addition of Petrochemical Processing Units. This shall ensure that there is an increase in GRMs for the refiner as also improving the petrochemical intensity of the nation. The report touches upon the Shale gas revolution, as well as, Carbon Capture and Sequestration as also the increasing trend towards Electric Vehicles."

- Mr. Niraj Sethi, Former Executive Director, Engineers India Limited

As an alumnus of SRCC, it gives me immense pride and satisfaction to see the young students of SRCC producing such an insightful report on "The Transformation of the Global Oil Industry". The report's journey—from exploring the historical origins of the oil industry, the 1970s oil crises and the rise of OPEC, to analysing present-day challenges such as environmental sustainability, the transition to renewable energy and the evolving geopolitical dynamics like the Russia-Ukraine conflict—is well-structured. This report is a testament to SRCC's legacy of academic excellence and forward-thinking minds. I congratulate the entire team of the commerce society for their dedication and the impressive scholarly contribution they have made to the discourse on the future of energy.
— Tushar Jain, Ex-Joint Director, PPAC (O/o Ministry of Petroleum & Natural Gas)

This report meticulously covers a comprehensive and insightful analysis of the historical and evolving landscape of the petroleum industry. The detailed examination of geopolitical influences provides valuable perspectives for industry professionals and policymakers alike.

-S C Gupta

Director Incharge (Monitoring)

Petroleum and Natural Gas Regulatory Board

Delhi, India

It was with immense pride that I read the report on "The Transformation of the Global Oil Industry" by The Commerce Society of my Alma Mater SRCC. I deal with many sectoral research reports and papers in my current role and can confidently say that this report is well researched, topic understood well and many hours of 'deep work' has gone into the publication of the content. I congratulate the young minds and future Industry leaders on this commendable effort.

- Ms. Anuradha Kapoor

Senior Vice President (Head-Policy)

Reliance Industries Limited



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Abstract

This paper explores the transformation of the global oil industry with special emphasis on geopolitics interventions, past perspectives and the growth prospects of it. We seek to dive deeper into the various global trends such as environmental commitments and pressures, cleaner energy, net-zero emission targets and the government interventions and policies to analyse how these affect the oil sector on the global level and its relevance with respect to sustainability, competitiveness and possible expansion.

First of all, we dive into the origins of the modern oil industry, examining significant milestones from the 1960s to early 2000s, explaining the shift in powerplay over one of the most critical resources for growth and development with both strategic and security implications by nations around the world.

Interplay of geopolitics through energy alliance, trade policy and global conflicts also surfaces as a pivotal influencer in driving the supply chain, market volatility and investment strategies in the global oil industry.

Through various case studies, the research paper also tries to analyse the effect of various global trends on the sustainability of the oil industry.

Environmental pressure, carbon neutrality, technological advancement and government policies, major and growing trends, set the stepping stone towards climate action and reducing emissions, bringing a structural shift in the industry.

We also look at how geopolitics and global trends intertwine to pave the growth opportunities with a focus on sustainability and a greener future. With a shift in focus towards building resilience in non-oil sectors and reducing dependency on oil, initiatives like Saudi Arabia's Vision 2030 and the European Union's REPowerEU encourage nations to take up sustainable practices in their oil industry.

In a nutshell, this research paper aims to navigate the history of the oil industry while examining the interplay of geopolitical powers and the influence of global trends in the growth perspectives and sustainability. Exploring and analysing the global oil industry adds to a holistic view of the relationships and dynamics between nations in their quest for strategic control and power.

Introduction

The oil industry is one of the most important sectors of the global economy, contributing to energy supply, economic growth, and geopolitics, while also serving as the backbone of many industries. Simply described, the oil industry is the global sector that explores, extracts, refines, transports, and markets petroleum and its products. Edwin Drake in 1859 marked the beginning of the modern oil business by drilling the first commercial oil well in Titusville, Pennsylvania, USA. Since then the industry has undergone significant transformations. Major discoveries of oil reserves in Pennsylvania and Baku laid the foundation for the ever-expanding path of large-scale petroleum production and consumption.

The focus of this report is to understand the evolution of the oil industry and how it has adapted itself to the changing global trends. Since the onset of the industrial revolution, the oil industry has grown as an important factor of power play and geopolitics.

Over the years, major events have contributed to shaping this industry. Through this report, we aim to analyse such events that have transformed the industry, whether it be the oil crisis of 1973 and 1979 that disrupted the global economy, leading to rising petroleum price, fueling shortage, and causing economic recession, or the rise of OPEC (Organization of Petroleum Exporting Countries) that shifted the power dynamics from the western players to five oil-producing countries (Iran, Iraq, Saudi Arabia, Kuwait, and Venezuela).

Analysing Global Trends

Additionally, this report also throws light on how various global trends have shaped and influenced the functioning of the oil sector around the world. Each and every sector of the economy constitutes a significant part of its business environment, and thus, it is also rightly affected by changes and developments taking place in its surroundings.

Moreover, we would explore how environmental pressure and growing emphasis on carbon-neutrality has significantly impacted public and investor sentiments, leading to drastic changes in the oil sector. The emerging concepts of sustainability, climate action plans and reducing emissions have brought about a paradigm shift in the global oil industry.

Furthermore, the report shall also explain how the newly set standards of renewable energy and net-zero goals have posed certain challenges to the dominance of the oil sector. The report shall aim to analyse and elaborate on the implications of various global initiatives like the Paris Agreement, carbon pricing, emissions trading schemes, etc. that focus on limiting global warming.

Moreover, through this report, we aim to study the various government policies and provisions, such as the introduction of carbon tax to curb emissions, subsidies, incentives for clean energy projects and stricter regulations on pollutants as well as the impacts of these policies on the demand and future of the oil industry.

Lastly, we shall also study how many technological innovations, be it the rise of Artificial Intelligence, Internet of Things, Carbon Capture and Storage, etc. have given shape to a reformed oil sector as well as how advancements in biofuels, hydrogen technologies have opened up cleaner avenues for energy alternatives.

How Geopolitical Shifts Are Fueling the Evolution of the Oil Industry

The oil industry has historically been a key driver of global geopolitical dynamics, influencing economic policies, international relations, and conflicts. Control over oil reserves has long been a source of political leverage, with major oil-producing nations shaping global energy markets through supply and pricing strategies. Organisations like the Organization of the Petroleum Exporting Countries (OPEC) and its extended alliance, OPEC+, have played a crucial role in regulating oil production to maintain market stability. However, the geopolitical landscape of the oil industry is undergoing a significant transformation due to evolving global energy policies, regional conflicts, and shifting economic priorities.

One of the primary drivers of this transformation

is the growing push for energy security and reduced dependence on traditional oil suppliers. Countries such as the United States and China are investing in domestic energy production and alternative energy sources to decrease reliance on foreign oil. Additionally, geopolitical tensions, such as the Russia-Ukraine war, have disrupted global oil supply chains, leading to price volatility and increased strategic competition over energy resources.

Moreover, the global shift towards renewable energy and carbon neutrality has forced oil-dependent economies, such as those in the Middle East and Russia, to diversify their energy portfolios. While oil remains a critical component of global energy security, its geopolitical significance is evolving as nations seek to balance economic interests with environmental and strategic considerations. Understanding these geopolitical shifts is essential to assessing the future trajectory of the oil industry in an increasingly complex global energy landscape.

Future Outlook and Growth Trends in the Oil Industry

The fate of the oil industry will be experiencing a major change in trajectory as Saudi Arabia's 2030 plan reaches its zenith. Saudi Arabia, the home to one of the world's largest proven petroleum reserves which is also among the largest exporter of petroleum oil enjoys a significant role in the total oil production in the entire world.

For years, Saudi Arabia has been wearing the crown of rich cash flows from oil products. Saudi Aramco, one of the world's largest integrated

energy and chemical industries has appeared as the leading company in supplying large quantities of oil.

Saudi Aramco was founded in the year 1933 by the then name, California – Arabian Standard Oil Company with the motive to fulfil the oil demands of European and North American countries during the increasing global tensions. In the year 1944, the company was renamed as Arabian American Oil Company while it extended its operations in the whole Arabian Peninsula. During the 1980s, the Saudi Arabian government began the process of nationalizing Saudi Aramco, and by 1981, it had become fully state-owned. Saudi Arabia enacts 23% of its GDP from oil rent making the country as the herd leader of OPEC.

But with the rapid change in the future demands and dynamics, Saudi Arabia, in 2016 launched its Vision 2030. With this vision, Saudi Arabia aims to reduce its reliance on oil and build resilience in non-oil sectors. The government is offering incentives and inviting foreign investments for sustainable development. This trend of minimising oil dependency is further supported by the European Union's REPowerEU which focuses on energy saving, diversification, and affordable energy to European users. This shift towards green independence will lead to interdisciplinary effect.

In a nutshell, this report shall be a profound description, analysis and overview of global oil sector and the factors that affect its functioning and future prospects. The Oil Sector is considered to be one of the most crucial constituents of the global economy and this report shall offer an extensive outlook on its future.

Historical Perspective

The Impact of Oil on Civilization

Throughout the history of mankind, energy and oil have been key drivers of quality of life and living standards. During the earliest times, people would chop down trees and burn wood for warmth and cooking. Wood was regarded as the chief fuel around the world, followed by the invention of the steam engine, which became increasingly popular as a mode of transportation.

Over time, civilizations found simple uses for oil that seeped from the ground—like waterproofing, lighting, and medicine. In places like Persia, it was known for centuries, but never produced in large quantities. By the 18th and early 19th centuries, as whale oil grew costly and scarce, the search for better fuels began. This rising demand set the stage for oil to become a serious focus of exploration and industry.



It wasn't until 600 B.C. that oil was discovered for the very first time by the Chinese and was transported using pipelines made of bamboo.

Then, in 1859, Colonel Edwin Drake discovered oil in Pennsylvania. He was associated with the Pennsylvania Rock Oil Company, which was formed with the purpose of exploiting oil floating on the surface water bodies near Titusville. It was this organization that sent Colonel Drake to the area to research and open up new horizons for the global oil industry.

The first oil well was discovered in Titusville, Pennsylvania and was successfully drilled on 27 August, 1859. This discovery kickstarted many major historical events, including the formation of the Standard Oil Company in 1870, which went on to control nearly 80% of the oil products market.



In 1909, antitrust laws caused the Standard Oil Company to split into 34 different companies, but by the 1940s 3 of them, along with 4 other international companies, grew to dominate the market and were nicknamed the "Seven Sisters". These companies included- Standard Oil of New Jersey, Standard Oil of New York, Standard Oil of California, Royal Dutch Shell, Texaco, Gulf Oil and Anglo-Persian Oil.

Gradually oil exporting countries became more protective of their oil resource and thus major companies had to negotiate deals with governments to continue to extract oil.

The 1970s Oil Crises

The 1970s was a witness to major price shocks fueled by geopolitical tensions and supply chain restrictions by the Organisation of Petroleum Exporting Countries (OPEC) that had a profound and lasting impact on the global economy. The first price shock occurred in 1973-74 as a result of the Arab oil Embargo, while the second oil shock was seen in 1979-80 due to the Iranian Revolution. Both the events led to soaring oil prices, economic disruption and fundamental shift in global policies. These events exposed the vulnerabilities of oil dependent economies and had long term implications on inflation, industrial output, consumer behaviour, government policy and global energy outlook.

The 1973-74 Oil Crisis

1973-74 witnessed the first major oil price shock with the augment of Yom Kippur War in October 1973, when Egypt and Syria launched

a joint attack on Israel which was supported by U.S and Western Europe. In retaliation to the support received by Israel, Organization of Arab Petroleum Exporting Countries (OAPEC), a subgroup of OPEC, announced embargo targeting U.S., Netherland and other countries supporting Israel, wherein there was gradual reduction in oil production and then complete halt on exports to targeted countries. This resulted in the rise of oil prices from \$3 per barrel to \$12 per barrel, between October 1973 and March 1974.

This four-fold surge in costs had a profound influence on many worldwide economies. With significant businesses across economies relying on oil, the price jump resulted in stagflation, which is when inflation rises but economic development stagnates. Long queues and rationing at petrol stations in the United States and Europe became the norm as the government placed limitations to manage the restricted oil supply. This was further accompanied by investor uncertainty and lower company profitability, which resulted in large equity market losses that harmed consumer and business confidence. Furthermore, the crisis also intensified diplomatic attempts to stabilize oil supply, resulting in increased US participation in Middle Eastern politics and the formation of strategic alliances with non-OPEC oil-producing countries.

The 1979-80 Oil Crisis

The Iranian Revolution in 1978-79 led to the second oil price increase due to a very significant reduction in Iran's oil production.

With the establishment of the Islamic Republic and the ousting of the Shah of Iran, the environment of political instability disrupted the global oil supply. This was further aggravated by the outbreak of the Iran-Iraq war in 1980, which further constrained oil production in the region. As a result of geopolitical tension and political instability in oil-producing countries, the oil prices doubled, reaching approximately \$39 per barrel by 1980. In today's time this means around \$100 per barrel.

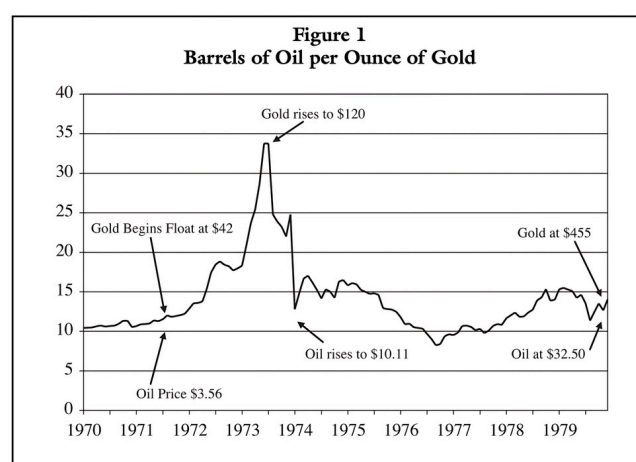
The sudden rise in oil prices caused economic instability globally, particularly in Western economies, like the United States, which faced economic slowdowns as increased energy costs affected consumer demand and industrial production. This crisis also intensified geopolitical tensions, as the Western governments pursued diplomatic and military methods to maintain stable energy supplies, expanding their engagement in the Middle East.

However, the crisis also witnessed some positive outcomes with auto manufacturers and industries developing fuel-efficient technologies to reduce dependence on oil, leading to significant advancements in vehicle design and alternative energy sources. Various countries also sought to diversify energy sources, increasing investments in nuclear, natural gas, and renewable energy to decrease reliance on Middle Eastern oil.

The 1970s oil price shocks significantly impacted commodity prices, in particular gold. The crisis led to profound economic shocks due to supply chain disruptions depicted by the increase in oil

prices from \$3.56 per barrel in the early 1970s to \$32.50 per barrel by 1979.

1973-74 saw growing economic uncertainty and inflationary pressures, where rise in oil prices was accompanied by a significant rise in gold prices. Post 1974 oil prices stabilized, but the energy market remained volatile. In 1979 geopolitical instability led to another sharp increase in both commodities leading to inflation and global recession.



The 1970s is a classic example of the geopolitical power exercised by oil countries over the weaknesses of oil-dependent economies. The crisis not only experienced disruptions in the international market but also resulted in significant policy reforms across the world. Although having harmful effects, the crisis also encouraged innovation and improvement in several sectors advocating energy security, economic diversification and sustainability.

The crisis also emphasized the significance of interreliance in the international economy among different countries. The 1970s experience becomes an essential reference point as the nations continue to move through energy transition on a sustainable path.

Rise of OPEC

OPEC's Early Formation and Strategic Goals (1960–1970s)

In 1960's OPEC began operations through unification between Iran, Iraq, Kuwait, Saudi Arabia and Venezuela for the purposes of collective oil policy coordination and pricing control following Western oil company's dominance. At that time the big Western oil corporations known as the "Seven Sisters" maintained control over production and market pricing which harmed revenue prospects of oil-exporting countries. The main purpose of OPEC was to establish reasonable financial compensation for oil producer nations alongside governing the worldwide petroleum industry.

The oil exporting countries dedicated their efforts to the 1960s to stop multinational oil corporations from imposing price cuts. The organization faced initial difficulties because member states had poor cohesion and inadequate means of enforcement. OPEC transformed into an influential global oil market power because of geopolitical tensions combined with increased energy requirements throughout the 1970s.

The transition from foreign control to national governance of oil industries became a primary organizational change within OPEC during this time. The government seized control of oil operations and developed independent pricing systems once they cut ties with foreign companies who used to dictate the prices.

The transformation of OPEC nations' economic control over their oil sector established their rising dominance in global energy markets.

OPEC expanded its international coordination capabilities by establishing its headquarters in Vienna in 1965 as a move to consolidate its formalized organization. The OPEC Conference together with the Board of Governors managed to establish common production approaches but persistent differences between member states almost hindered the organization's complete cooperation.

OPEC's potential status as a global leader in geopolitical and economic aspects became more prominent during the early 1970s which led to its surge as a major global force.



The 1973 Oil Embargo: OPEC's Defining Moment

OPEC's ascent to power achieved its most important milestone during 1973.

The Yom Kippur War, initiated by a coalition of Middle Eastern states, led to a major realignment in global energy industry dynamics. When the United States and the Netherlands sided with Israel, OPEC members in OPEC as part of the Organization of Arab Petroleum Exporting Countries boycotted their oil supply. Oil began to be used intentionally as an economic weapon for the first time throughout this period.

The embargo immediately created tremendous changes throughout world energy markets. The global oil prices reached historic highs starting with a 70% increase in 1973 October then reaching another peak with a 130% rise during December. During the following months the petroleum barrel price soared four times higher. The embargo triggered acute fuel shortages which led Western economies including Europe and especially the United States to face rationing along with devastating inflation problems.

This event created an everlasting impact on how OPEC functioned as a global power bloc. Through this event the OPEC organization showed the world it could regulate oil supply to establish worldwide pricing standards thereby manifesting energy as a strategic geopolitical resource. Members of the Organization of Petroleum Exporting Countries used their abundance of oil profit to implement major economic development initiatives combined with expansions in infrastructure and international venture investments. The Oil Boom Era of this period led to wealth growth throughout countries rich in oil production.

The Western world started putting energy

efficiency at the top of their list while researching new alternative fuel systems and boosting their home-produced fuel supplies because of their OPEC oil dependency. OPEC became an unopposed major global energy authority which strengthened its leading position in the global oil industry throughout the short-run.



OPEC's Continued Dominance and the Second Oil Shock (1974–1980s)

Following the success of the 1973 embargo, OPEC entered a period of sustained power, with oil prices remaining high and the organization holding firm control over production levels. The newfound wealth allowed member states to expand their influence on the global stage, funding domestic economic initiatives and investing heavily in Western economies. Many OPEC nations also used their oil revenues to support regional political agendas, further solidifying their presence in international affairs.

However, OPEC's next major power play came in 1979, during the Iranian Revolution. The overthrow of the Shah and the subsequent turmoil in Iran's oil sector led to a drastic

reduction in production. This supply disruption, coupled with geopolitical instability, caused oil prices to double, triggering the Second Oil Shock. Once again, OPEC demonstrated its ability to shape global markets, with oil prices soaring and Western economies struggling to cope with inflation and recessionary pressures.

During this period, OPEC also focused on strengthening internal coordination. While individual member states still had control over their national production levels, the organization worked to establish a more unified pricing and supply strategy. Saudi Arabia, as the largest producer, played a key role in balancing global supply and stabilizing market fluctuations.

The sustained period of high oil prices reinforced OPEC's economic dominance, and the wealth accumulated during this time allowed member states to further develop their domestic industries. Infrastructure projects, social welfare programs, and international investments flourished, transforming oil-rich nations into global economic players.

By the early 1980s, OPEC had firmly established itself as a leading force in global energy politics, with its ability to control supply and dictate prices making it one of the most influential organizations in the world.

The Shale Oil Revolution

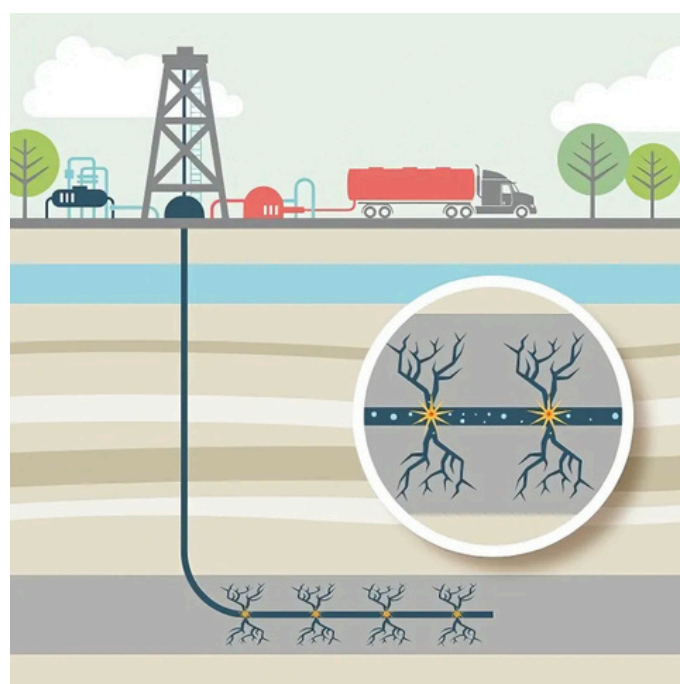
Shale and its extraction process

Shale rock is a finely grained, sedimentary rock formed by the compaction and intense pressurisation of clay, silt, and organic matter over geological processes. Shales were deposited in the seas and riverbeds in ancient times and are abundantly found both at the earth's surface and in the underground depths. Shale gas, which is the mixture of naturally formed hydrocarbon gases from decomposed organic matter, i.e., plants and animals' decays, is trapped in microscopic pores in between the layers of shale rocks. Gas is used as the source of energy for the generation of electricity and for domestic uses. The hydrocarbons, the oil and gas formed from the increased temperature and pressurised environment, move upwards beneath the rock layers until sealed by the impermeable hard rock. Shale is an unconventional hydrocarbon, which is extracted through the astronomically complex process of hydraulic fracturing.

Hydraulic fracturing is the process of extracting the shale gas. It begins by setting up the whole plant, including the drilling hydraulic machine, the water pit, and the extensive pipeline network. The extraction process begins by drilling deep down in the Earth's crust about a mile deeper and then pivoting at a right angle to stretch horizontally for some hundred meters so that it aligns parallelly along the horizontal layers of the shale rocks where the gas is trapped in the cracks.

Through the vessel, the perforating gun-type mechanism is fired to form the openings into these cracks. Fracking fluid is then filled into this drilled vessel with pressure which is high enough to widen the cracks, making the gas trapped inside them escape. This fracking fluid includes added debris, clay, and silt to keep the gaps open and running; slick water to add the lubricant; and disinfectant to keep the bacteria at bay. This fluid is then pulled back out of the vessel and then treated to separate the fluid and the gas obtained.

This entire process of hydraulic fracturing, more popularly known as 'fracking,' has transformed the oil extraction landscape and has fulfilled the energy demand all around the globe, especially executed perfectly by the United States, eventually transforming it from the importer to the exporter of crude oil and gasoline.



Shale oil and America

America used its capital backing to execute the massive operation of extracting shale oil. Since the location of these extraction points depends on many factors like the availability of drilling rigs and labour and uninterrupted regions, it has been comparatively difficult to carry out the operations on a large scale to justify the huge first capital requirements in other countries. The shale oil extraction brought a revolution in the USA's landscape of manufacturing and import transactions of crude oil from the rest of the world. The expansion of shale extraction became so efficient that the International Energy Agency predicted America to become 'the world's leading crude oil producer,' eventually leaving behind Saudi Arabia's reign of oil supplies, eventually evolving into the net crude exporter by the year 2030.

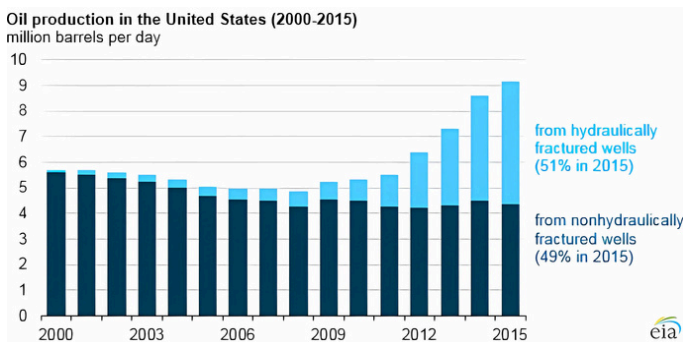


Fig: U.S. Energy Information Administration

The same study also included the statistics marking the US as the leading oil-producing country from 1973 to 2014. But still the country's oil supply could not be safeguarded from the major oil price shocks, as although the US oil production was the highest, it could not keep up pace with the domestic demand for oil, which resulted in exposing the country to the global changes in the oil prices.

Production could also not protect the country from the 1990 oil price spike, explaining that the leading oil extraction provides still little safety when it comes to the global view.

The trends of oil production in the US display some interesting observations. During the first years of this technology's introduction, production increased rapidly, but later the graph became more linear. Another angle is the concentration of the shale production sites to some limited areas, majorly in Eagle Ford and the Permian Basin in Texas and the Bakken in Dakota, which make up more than half the output.

Now to understand the eventual effect of the shale revolution on the U.S. price of oil, the understanding of the whole market chain of the crude oil becomes pertinent. Crude oil goes to the refineries where it is refined to diesel, gasoline, and other by-products. Refineries differ in their optimisation for light sweet crude oil, heavier, or sour crude. Gulf Coast refineries in America are invested in processing the heavy crude imported from Saudi Arabia, Venezuela, and Canada, while the East Coast refineries are involved in light sweet crude and later shale oil. But from the surface, the shale oil, which is mostly light sweet crude, should have been easily absorbed by the already set up U.S. refineries, but the reality was significantly impacted by the infrastructure problems caused by the supply glut. The shale oil flooded in Cushing and Oklahoma, which are the main oil hubs of the country due to a lack of pipelines to East Coast refineries. At the same time, Texas refineries were not well equipped for large-scale oil processing and the pipeline was historically

built for import of oil and not for redistributing domestic production. This mismatch led to intense price disparities, leading to trade with the crude below the global benchmark. Despite excess oil in the Midwest region, the East Coast had to import the crude for even higher prices, leaving the U.S. oil market regionally fragmented.

Externalities of shale extraction

However, this entire process is not a pure gold mine. There are certain problems related to it. The excess drilling and artificial crack formation give rise to active seismic activity like earthquakes in the nearby regions of the extraction site. Another major problem is the methane seepage through the inefficient drilling and pumping system.

Although the shell of the vessel is made of impermeable material, any crack or slight opening in this shell can pollute and infect the groundwater, introducing the nuclear and unfiltered substances to the freshwater source of the nearby households, raising a lot of concerns. The question has been put in frame a lot of times inquiring the worth of time, money, and other resources, justifying the shift of focus from development of other renewable energy sources, by merely calling shale as the bridge to the future avenues of energy. The concerns are so high that even some of the European countries have banned shale oil extraction due to the dramatic problems it gives rise to.

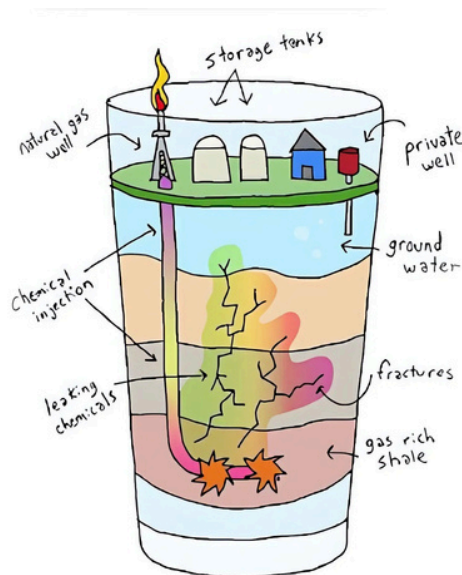


Fig: 'Is Fracking About To Arrive On Your Doorstep' by Ellen Cantarow

Global Developments

Environmental Challenges

The rise of the modern global oil industry over the years has had a significant environmental impact due to its processes of extracting, refining and distribution of fossil fuels that cause pollution, land degradation and climate change.

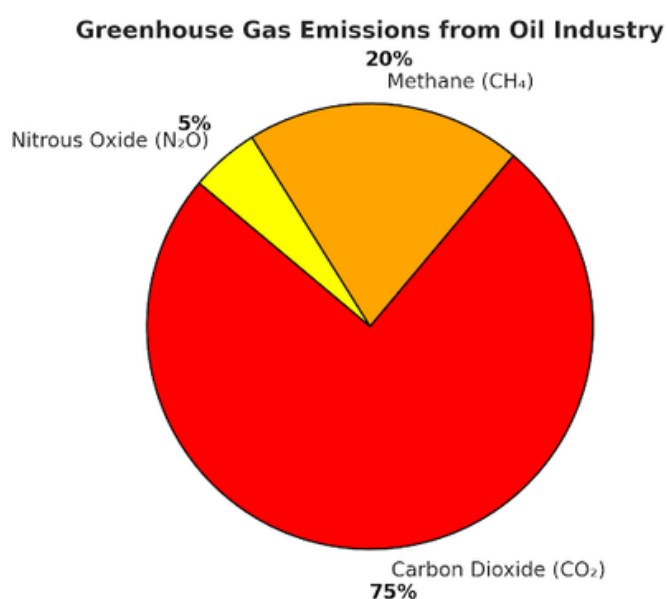
Processes such as oil extraction, refining, and distribution releases high amounts of greenhouse gases like Carbon dioxide (CO₂), methane (CH₄), nitrogen oxide (N₂O), sulfur dioxide (SO₂), and particulate matter (PM), inducing global warming, air pollution, and climate change. The discharge of effluents damages both animals and humans, causing a variety of ailments. Increased emissions of these gases diminish the level of dissolved oxygen in water bodies, hurting aquatic life as well.

Furthermore, oil spills from tankers, pipelines during transportation, and offshore drilling rigs contaminate oceans, rivers, and lakes, preventing sunlight from entering water bodies, harming marine life and ecosystems. During oil extraction toxic chemicals seep into groundwater and poisons drinking water combined with harmful chemicals making it unsafe to use. This is accompanied by destruction of habitats and loss of biodiversity due to oil drilling and infrastructural development. Deforestation, soil erosion and contamination of land due to mismanaged disposal of byproducts and are sightings of this industry.

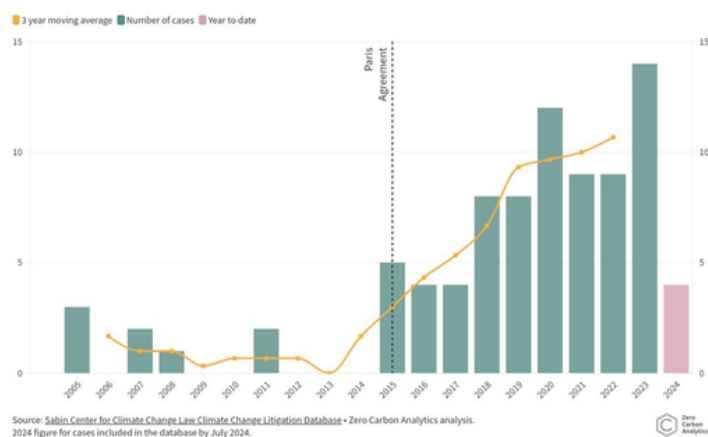
Pressure from Different Stakeholders

Governments all around are now enforcing rigorous rules aiming at the decrease of greenhouse gas (GHG) emissions, directly impacting the oil sector. According to International Energy Agency (IEA) estimates, the oil industry accounts for around 15% of the greenhouse gas emissions; hence, the government developed measures like carbon price, emissions caps, and renewable energy standards.

As focus is shifting to climate, oil companies are now undergoing legal action due to their ecological footprint. With an increase in environmental activists trying to hold various oil companies accountable for their carbon emissions harming the environment, we are



witnessing a rise in climate litigation cases around the world. Further, firms are being compelled to adopt more sustainable and open practices after going to court and having a negative backlash for deceptive eco-friendly, practice claims.

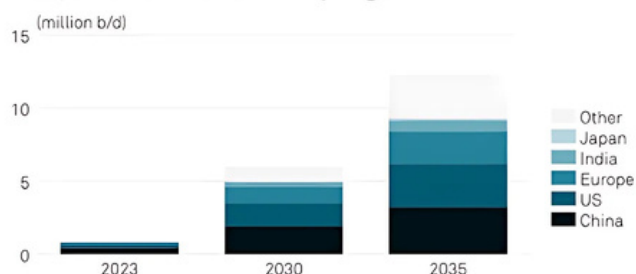


The finance sector is also moving towards environmental, social, and governance (ESG) standards. This means oil companies are receiving pressure to change their ways and be more eco-friendly. If they don't want to risk losing investors and access to money.

Even though Shell predicts that global gas use will increase by 60% by 2040, however, with the current trend of adopting cleaner alternatives, combined with increasing consumer awareness and efforts to cut emissions in heavy industries, the oil demand is changing because of more electric vehicles, better energy efficiency, and policies that support renewable energy. This trend towards sustainability acts as both a challenge and an opportunity for companies to adapt and innovate.

Oil Displacement from EVs by region

Oil displacement from EVs by region



All of this is leading the oil industry to spend large amounts of money to combat environmental issues. They are focusing on carbon capture and storage, finding methane leaks, and mixing renewable energy with their usual operations. The International Energy Agency (IEA) highlights that the mitigation of methane emissions is an economical means by which the industry can reduce total greenhouse gas emissions.

The oil industry is changing and adapting because of environmental issues. Companies are being forced to think creatively and adapt to new energy trends. They are facing various factors like rules from the government, what investors want, climate risks, new technology, market changes, and legal problems. To succeed in this new time, oil companies should focus on sustainability and make it a big part of their plans.

Technological Progress and Industry Adaptability

To fight against environmental challenges, the oil sector is spending billions of dollars on new technology. Firms are weighing carbon capture and storage, methane leak detection, and employing renewable energy as a component of their operations. The International Energy Agency (IEA) states that curbing methane emissions is an economic means for the industry to lower total greenhouse gas emissions.

Technology improvement in digital monitoring, artificial intelligence, and robots is making the oil firms leaner and greener. Progress in biofuels, hydrogen fuel, and off-shore wind farms are being considered future alternatives to provide power. All these investments signal a change in where the industry is heading, with sustainability as a core part of their business model in the long term.

Also, there are some firms that are reusing existing oil fields to produce geothermal energy, utilizing existing infrastructure for cleaner energy sources.

Investment in battery storage technology and smart grids is also on the rise, facilitating greater integration of renewable energy sources into the power grid.

Investigations into clean fuels, including algae-based biofuels and synthetic fuels, are becoming increasingly popular, promising potential low-carbon alternatives to transport. Oil companies are also collaborating with renewable energy companies, investing in solar and wind power on a large scale to complement their conventional business models.

The oil industry is changing and adapting with green concerns. Companies are being pushed to innovate and adapt with new energy paradigms. Companies are facing several drivers such as government regulations, investor expectations, climate hazards, new technologies, market changes, and litigation. In order to thrive in the changing scenario, oil companies have to think about sustainability and make it a part of their plans.

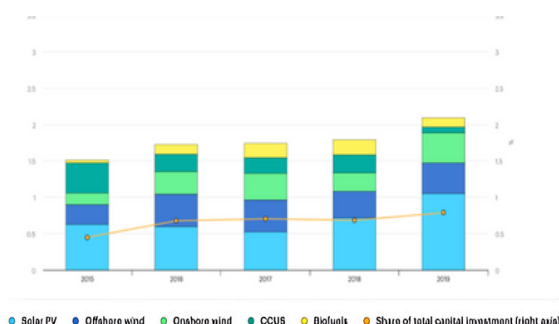
The Transition to Renewable Energy

The Concept and Implementation of Energy Transition

The highly concerning issues of climate change and global warming have forced the world to shift over to cleaner and renewable forms of energy, be it water, wind or even solar energy. Many households and industries such as transport and manufacturing have drifted away from fossil fuel based devices to using eco-friendly appliances. Fossil fuels like oil, natural gas, petroleum, diesel, etc have powered economies for decades, however, their detrimental environmental impact- mainly the release of greenhouse gases like carbon dioxide has catalyzed a paradigm shift towards greener alternatives. This phenomenon involving a major transformation of energy supply sources is known as energy transition.

By 2023, wind and solar energy made up for 13.2% of global energy consumption, while fossil fuel usage continues to decline. But, it is estimated that the share of fossil fuels in the total energy mix will fall from 80% in 2020 to just over 20% in 2050. However, their use will not become absolutely zero; instead, significant amounts shall still be used to produce non-energy goods. Carbon capture and utilization storage (CCUS – Carbon capture and utilization storage) technologies shall be used in sectors where emissions are particularly difficult to reduce, such as heavy industry and transport.

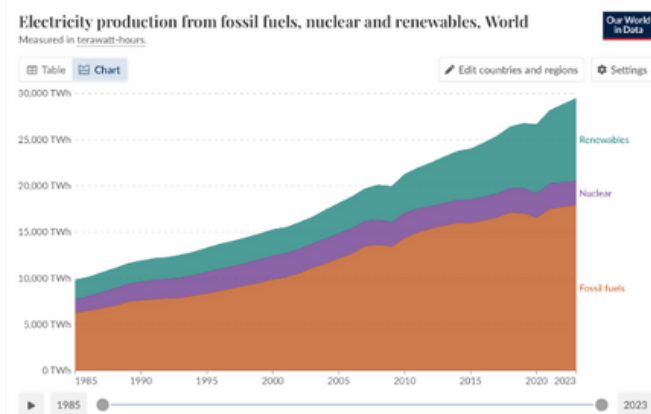
Capital expenditures on new projects outside of core oil and gas supply by large companies, absolute and as share of total capex, 2015-2019



The graph highlights the overall increased capital expenditure on renewable energy projects by large companies around the world, during the period 2015-2019.

The implications of the global energy transition for the global oil industry are wide-ranging and its consequences are becoming gradually more and more evident. Over the period 2019-20, global oil consumption declined by 7%, coal consumption fell by 4.4%, and natural gas consumption decreased by 2.8%. Moreover, experts predict that oil consumption will drop to 14 million barrels per day by 2050 from the current level of 102.43 million barrels per day. The use of coal is expected to fall from 5,250 million tons of coal equivalent in 2020 to 2,500 million tons of coal equivalent in 2030 and to less than 600 million tons in 2050 – an average annual decline estimated at 7% per year. Additionally, demand for oil is expected to fall to 72 million barrels per day in 2030 and 24 million barrels per day in 2050 - an average annual decline of more than 4% through 2050.

This graph shows how the utilisation of renewable energy has continued to increase since

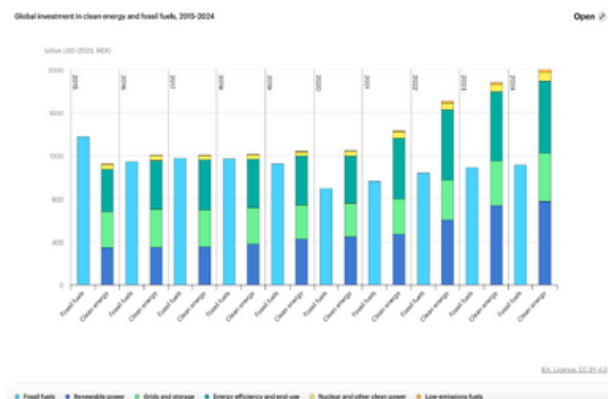


1985, although fossil fuels are still the largest sources of electricity production currently.

Energy Transition in the Corporate World

In this background and in order to fulfill sustainability standards, many national oil companies (NOCs) have also shown commitment towards net-zero emission goals. At the same time, rapid advancements and cost reductions in renewable energy have driven million dollar investments towards the same. For instance, 3 leading oil companies in the United States have made notable investments in the renewable sector. British Petroleum (BP) has maintained a diversified investment portfolio across 5 major transition categories- bioenergy, EV charging, convenience, renewables and hydrogen. Furthermore, Enbridge has been developing several offshore wind farms in Europe and it, along with TotalEnergies, has also accelerated its renewable energy investment pipeline through acquisitions. In late 2022, Enbridge acquired leading U.S. onshore renewable project developer Tri Global Energy. In early 2023 it acquired a stake in leading RNG infrastructure company Divert.

As a result of the declined demand and consumption



of oil, economists expect the oil prices to fall in the near future. During the transition period, the market may face increased price volatility as it adjusts to the new demand and supply. This may cause a temporary rise in prices, as oil companies would look to maintain their profits and minimise losses by increasing their prices. However, in the long run, this move may further lead to faster adoption of renewable energy, thus creating a positive feedback loop that would push prices down further.

According to a survey conducted by the Statista Research Department in the United States (2023), the majority of U.S. oil and gas company executives expect the energy transition to lead to a slight or a significant increase in oil prices in the short run, expecting a panic-stricken reaction from companies to save their profits.

In a nutshell, the transition from crude oil to renewable energy poses both opportunities and challenges for the global oil sector. Decreasing demand for fossil fuels, changing consumer preferences and the introduction of carbon pricing systems has compelled companies to innovate and adapt. Companies, in return, are expanding their renewable energy portfolios and exploring environmentally conscious business models.

Net Zero Goals

Net Zero refers to the balance between the amount of carbon emissions released into the atmosphere and the amount removed from it. Minimising emissions serves as the first step toward net zero and carbon absorption projects function as the complementary strategy to eliminate all remaining air pollutants. The world needs net zero status to protect both Earth's climate stability and its liveable environment.

Research conducted by scientists confirms that keeping global temperatures less than 1.5°C above pre-industrial periods becomes essential to avoid serious climatic impacts. Since the late 1800s the Earth has experienced warming of 1.2°C yet emissions continue to increase. The Paris Agreement targets dictate that global carbon emissions need to decline by 45% by 2030 before achieving complete zero emissions by 2050.

Strategies and Challenges in Achieving Net Zero

Net zero transformations demand total reorganization of energy manufacturing alongside changes to how we use and transport energy. The energy sector stands as the main source of greenhouse gas emissions which control approximately three-quarters of the total emissions. The transition to net zero depends on three main strategies that combine abolishing fossil fuels yet increasing solar and wind power along with better industrial and residential energy efficiency and the implementation of eco-friendly transportation systems. The critical function of achieving net zero emissions depends on carbon

capture and storage (CCS) advances and nature-based solutions including reforestation and soil carbon sequestration techniques that will balance unavoidable emissions.

More and more national governments together with urban entities and corporate entities and educational institutions are setting targets to achieve net zero status. The net zero commitment now has been adopted by 107 countries which comprise 82% of total global greenhouse gas emissions through their official policies and legislation or declarations. More than 9,000 companies together with 1,000 cities and 1,000 educational institutions and 600 financial institutions volunteered to participate in the Race to Zero dedication to reduce emissions by half before 2030. Achieving these commitments demand specific measures including enhanced environmental regulations, additional financing for green infrastructure and financial structures that enable low-carbon transitions using green bonds and carbon pricing.

The numerous net zero pledges that organizations have made differ substantially in their strength levels. The creation of the High-Level Expert Group on Net-Zero Emissions Commitments of Non-State Entities by the UN Secretary-General in March 2022 focuses on both accountability and faster implementation. The group made its recommendations during COP27 in November 2022 for establishing uniform assessment standards targeting non-state entities particularly cities and businesses. The process of independent verification along with transparent

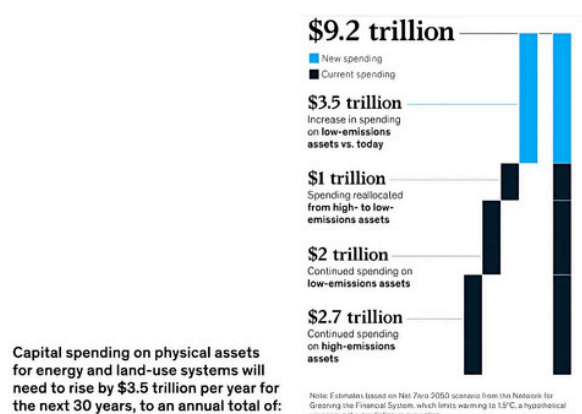
reporting guarantees that environmental commitments achieve genuine emissions reductions above marketing claims.

The world has yet to create sufficient action toward reaching net zero targets. An evaluation of Paris Agreement Nationally Determined Contributions shows present national targets will produce just a 2.6% decrease in worldwide emissions yet the needed decrease stands at 43%. The development of national and corporate climate strategies needs substantial enhancement to reach net zero status by 2050. The implementation of low-carbon systems requires substantial economic examination while people face difficulties between immediate financial consequences and enduring sustainability goals and the need for considerable clean energy funding. Global response success depends on political commitment together with international collaboration since border-aligned policies provide the required coordinated action



Such economic change for net zero transition will require broad-scale modifications. The analysis concentrates on four key areas which include demand analysis and capital resource distribution and operational expenses and employment measurement. During the period from 2021 to 2050 physical asset spending for the energy and land-use systems needs to exceed current levels

by approximately 60 percent through \$3.5 trillion annual investments on average. A combination of inflation-adjusted population growth plus existing transition policies would decrease the required investment amount to approximately \$1 trillion but the cost would remain larger than current levels by \$1 trillion. Physical asset spending in the areas evaluated would amount to \$275 trillion from 2021 to 2050 for the Net Zero 2050 scenario which represents 7.5 percent of GDP during this period. The demand analysis reveals declining coal and oil and gas production patterns alongside disappearing sales of internal combustion engine vehicles because zero-emissions alternatives like battery-electric and fuel cell-electric vehicles will outpace combustion vehicles in the future market.



Economic Impact and Corporate Responsibility

Making the transition to net zero depends on major financial investments. The estimated \$275 trillion allocation for energy and land-use systems during 2021 to 2050 will result in yearly expenses of \$9.2 trillion. The increased spending level amounts to seven percent of worldwide household spending during the year 2020. The invention of new technologies has the potential to reduce net zero costs so these solutions become

affordable. The industry must create new funding approaches including public-private partnerships primarily to obtain needed resources for big renewable energy initiatives and smart grid installation as well as urban sustainable development.

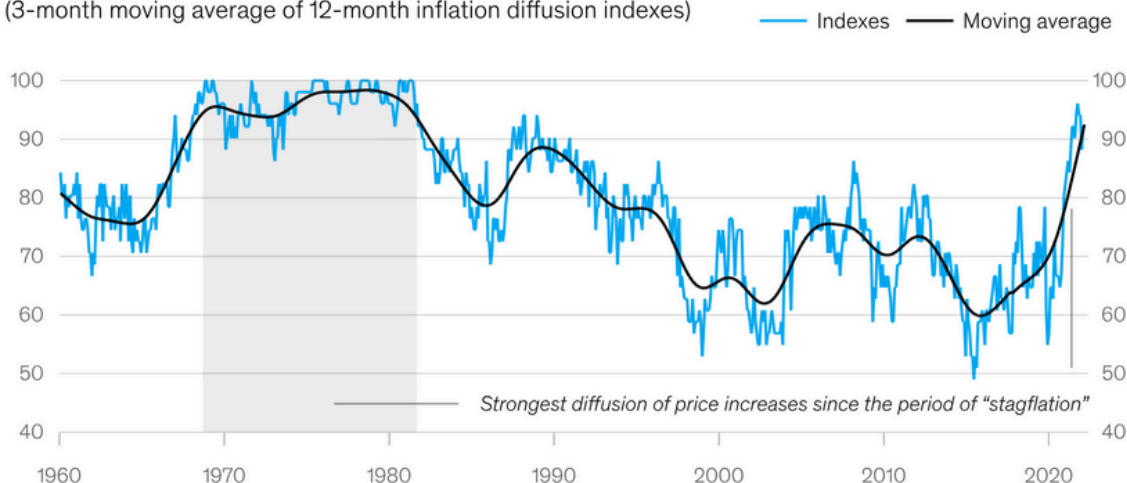
Business entities act as fundamental agents to reach the goal of net zero emissions. Research on the G2000 confirmed that 37% of companies made net zero emission commitments while 33% pursued inadequate reductions and 18% maintained operations on target for 2050. Businesses encounter obstacles in complete decarbonization because they remain reliant on carbon-intensive supply chains coupled with regulatory constraints and the expensive nature of moving into sustainable operation methods.

The combination of core business strategy integration with digital solutions such as artificial intelligence for energy efficiency boosts sustainability progress rates.

Achieving the 1.5°C warming target requires emission peak before 2025 while emissions need to drop 43% by 2030 with net zero as the final objective for 2050. The ongoing rate of environmental protection efforts shows an insufficient rate of progress. Public and private organizations together with institutions need to materialize their reduction targets into active measures which reduce emissions. Timely economic and societal changes of magnitude need to occur to establish sustainable practices in the future. The gap between climate promises and actual emissions decreases through essential policy frameworks, improved financial support systems and advanced technological developments. Global action with determination leads to achieving net zero goals that establish both environmental sustainability with economic durability.

Pricing pressures have spread across more than 92 percent of consumer spending categories.

Consumer spending categories with price increases over previous year through June 2022, % share (3-month moving average of 12-month inflation diffusion indexes)



Source: Federal Reserve Board of San Francisco; SGH Macro Advisors; US Bureau of Economic Analysis; McKinsey analysis

The Impact of Government Policies

Since the beginning of modern civilization the worldwide petroleum industry maintains its central position because it powers economic development and facilitates global trade as well as driving industrialisation and energy generation. Since the beginning of recent decades the global oil industry has faced radical change because of governmental policies together with evolving worldwide developments. The industrial sector has undergone major changes because of numerous elements that include environmental worries about climate modification together with new technological breakthroughs and changing energy requirements and international political developments. Government bodies from across the world have implemented various measures to control production while promoting alternative energy technologies and working on environmental solutions. The paper includes an aim to analyze how primary global trends combined with government regulations guide the transformation of the oil industry while revealing their immediate effects on producers and consumers together with their economic consequences.

The oil industry experiences a major trend which includes a decreasing usage pattern of fossil fuels. Several industrial countries have shifted toward reducing their dependence on oil because environmental interests now combine with new legislative frameworks and alternative source developments. The rising use of electric vehicles combined with industrial improvements in energy efficiency together with environmental sustainability knowledge gained by consumers

are key drivers of this trend. Large financial entities together with major corporations have chosen to shift their investments from fossil fuels into renewable energy projects. This paradigm change compels oil organizations to redesign their extended planning approach by shifting capital toward alternative renewable energy solutions.

Technological progress creates positive and negative effects on the transformation of the oil industry. Through hydraulic fracturing (fracking), horizontal drilling, and enhanced oil recovery (EOR) techniques, oil producers access untapped petroleum resources, prolonging the operational period of established wells. Emerging renewable energy technologies, including battery storage, carbon capture, and hydrogen fuel cells, aim to surpass the established power of oil. Pollution-related power systems are advancing rapidly through technological improvements, driving the international movement toward sustainable energy supplies.



South and East Asia and Latin America present a growing challenge to established leaders in the oil production sector such as Saudi Arabia together with Russia and the U.S. Brazil along with

Canada and Guyana have discovered new oil reserves which enabled them to build better extraction capabilities that extended their global market presence. Over the years the Organization of the Petroleum Exporting Countries (OPEC) has maintained its ability to direct global oil prices and adjust supply levels through collaborative production strategies. Alternative renewable energy sources together with government-implanted decarbonisation measures are steadily diminishing the oil-producing nations' dominance.

A combined initiative between federal authorities and business entities and individual consumers leads the world toward renewable energy power systems. Major companies that operate in the oil industry acknowledge the permanent shift toward renewable energy so they are building new business divisions dedicated to solar energy and wind power and hydrogen technology. China along with European Union member states are promptly building up their renewable energy systems to lower their dependence on fossil fuels. Members of the United Nations have adopted the Paris Climate Accord which set stringent carbon reduction targets that push nations to design rapid oil transition policies.

Government Policies Influencing the Oil Industry

Modern regulations function as a definitive system to direct the future course of the oil sector. Governments from all nations currently enforce strict regulatory measures such as carbon pricing systems combined with emission limit requirements and clean power standards to fight against fossil fuel emission damage.

Various regions have started using carbon taxes along with cap-and-trade programs which impose financial consequences on oil companies between adopting cleaner production techniques and non-compliance. Oil companies need to develop innovative solutions which enable them to satisfy sustainability regulations without diminishing their financial performance.



The transition from oil dependency gets promoted by governments through financial aid programs which support renewable power industry growth. Several national agencies implement subsidy programs that cover electric vehicle tax credits together with funding initiatives for solar and wind energy development and eco-friendly technology research. Germany together with Norway have led successful efforts to lower oil consumption through large subsidies which enhance the cost-effectiveness of renewable energy systems. Speedy technology adoption throughout industry sectors and residences depends on the adoption of these green policies.

International trade together with geopolitical conditions strongly affects the operations of the worldwide oil market. Major economies create supply-demand-price fluctuations through their imposed sanctions on oil-producing nations as well as their trade agreement transformations and political diplomatic interactions. Central to prices

changes are U.S. economic restrictions on Iran and Venezuela which have reduced global oil supply. The production decisions made by OPEC+ member nations through strategic alliances guide the levels of global energy supply. The emerging trade policies which target carbon-intensive imports will affect oil-exporting economies by requiring them to adapt their operations to emerging market conditions.

Government entities worldwide have set very ambitious goals to achieve net-zero emission targets through complete shifts toward sustainable energy by year 2050. The targets are supported through different policies which seek to eliminate reliance on fossil fuels. Some governments enact a two-pronged strategy by restricting internal combustion engine vehicles and preparing deadlines for coal power plant shutdowns while investing in large-scale CCS facilities. Sustainability demands require oil corporations to change their business strategies and identify cleaner energy sources so they can survive in a changing energy market.

Human and Economic Impact of the Oil Industry's Transformation

Widespread changes throughout the oil industry require the workforce to modify itself accordingly. The renewable energy sector presents expanding job prospects specifically when jobs disappear from traditional oil sectors. Repayment through training initiatives comes from governments together with private sector industries to move workers between fossil fuel-based roles into renewable energy jobs. There are two growing employment sectors that develop

new abilities because of their focus on wind and solar power production and electric vehicle development alongside energy efficiency improvements.



The countries that built their economic stability on oil production now struggle to shift towards changing energy patterns. Owing to oil scarcity, many Middle Eastern countries like Saudi Arabia invest in technological development, markets, and alternative energy solutions as economic diversification measures. Through its Vision 2030 initiative Saudi Arabia works to decrease dependence on oil money through enhancement of non-oil economy sectors. The energy transition creates economic obstacles for the present but simultaneously develops chances to build sustainable economic systems which can withstand challenges over the long term.

The oil industry transforms according to how consumers behave in the market. The rising environmental perception of climate change together with the negative effects of fossil fuel usage has boosted market demand for sustainable power alternatives. People currently choose electric cars alongside solar panel installation as part of their efforts to reduce their environmental impact. Organizations in the marketplace establish net-zero goals and practice energy conservation methods through their operations

and use sustainable supply chain policies. The combination of consumer and corporate behavioural changes drive faster the reduction of the world's dependence on oil.

Three principal factors consisting of economic elements and technological developments and government-implemented regulations push global oil industries toward transformation. The reduction of world reliance on oil appears to be a gradual process yet government decisions still speed up progress toward sustainable power systems.

Experts report that the industry involves three main forces which remake the market structure: technology development and shifting production methods together with consumer market changes. The future low-carbon world requires the oil industry to change its methods because it needs to follow updated regulatory requirements and changing market conditions and economic situations. The collision of worldwide trends together with governmental rules will set both speed and magnitude of this transformation that will define future energy condition.

ESG Metrics in Oil

ESG Metrics:

The importance of ESG (Environmental, Social and Governance) metrics in corporate strategy has increased significantly over the last couple of years. As the complexity of multinational organizations increases with stricter rules, technological disruptions and market shifts, ESG has become a vital element of the updated company policies around the world.

In layman terms, ESG metrics can be defined as quantifiable measurements of a company's performance in environmental, social and governance areas. They allow companies to identify various risks and opportunities and then align their functioning such that they're able to fulfill their ESG commitments. The 3 major components of ESG metrics are:

- a) **Environmental:** This focuses on the carbon footprint, emission levels and energy efficiency of the company.
- b) **Social:** This is centered around inclusivity, diversity of employees, fair labor practices as well as proper working conditions.
- c) **Governance:** This is mainly concerned with legal compliances with respect to board structures, compensation structures, etc.



1. Rising Importance of ESG:

With greater access to technology and improved communications, investors now have greater access to data than ever before. Thus, while making investment decisions, it becomes easier for them to spot discrepancies between the reported information and actual performance of the company. Consequently, companies that are mindful of these standards are rewarded with positive financial repercussions and they also assist their shareholders in becoming more conscientious.

The oil industry has been significantly impacted by the introduction of the ESG metrics. Investors that identify as socially conscious prefer to invest in those oil companies that give top priority to ESG compliance within their organization. At the same time, a notable increase in requests for environmental impact reporting by the existing investors and stakeholders has been observed. Apart from the investor benefits, there is also growing regulatory pressure to comply with the new rules and regulations and meet the worldwide environmental imperatives.

In the United States, the natural gas industry is the largest emitter of methane in the entire world and as per an EPA press release in November, 2021, one third of the global warming from greenhouse gases is caused by methane emissions. Due to public awareness and governmental pressure, many major oil and gas companies like ExxonMobil, Total, and Shell are proactively supporting efforts to combat climate change. These efforts include reducing carbon and methane emissions in their own operations, as well as promoting research on renewable energy

sources. This has caused many other oil and gas operators to also develop short-term and long-term goals and objectives around ESG. Furthermore, these trends are likely to continue in the future as the consumers become more and more environmentally conscious.

These ESG metrics set high ethical standards for oil and natural gas companies and those who fail to comply with these regulations may face a competitive disadvantage and regulatory penalties. A lack of an ESG strategy will also hamper the country's access to both private and public capital, which shall destroy the value of the company. Moreover, consumers that are highly ethical and sensitive towards the environment may avoid buying products from such companies, thus negatively affecting their revenues and profits. On the flip side, this also provides various companies to demonstrate leadership and invest in new technologies to reduce environmental impact and improve efficiency.



2. Financial Impact of ESG on National Oil Companies:

Taking a look at National Oil Companies, multiple pressure points are driving NOCs to address ESG concerns effectively. ESG gained popularity through the United Nations Environment Programme Finance Initiative

which coined it in 2005 and since then a UN-led ESG ecosystem has formed. Several organizations from the United Nations-led ESG ecosystem have evolved into a complex system that requires NOCs and their shareholders to demonstrate improved ESG practices. The UN Global Compact launched in 2000 together with other ESG initiatives forms a United Nations-led ecosystem that targets non-financial corporations to adopt 10 principles concerning environmental responsibility as well as anti corruption practices and labor and human rights. A minimum of 16 National Oil Companies have formally joined to support the organizational framework. Asset managers and asset owners join together through the investor-led Principles for Responsible Investment that promotes the integration of ESG elements into their investment choices. The principles currently receive backing from worldwide financial institutions across 80 different countries which manage \$120 trillion worth of assets.

The Principles for Responsible Investment now have financial institutions as signatories who use this stance to affect ESG practices. Shareholders from financial institutions are currently enforcing ESG practices on International Oil Companies and are expanding their efforts to National Oil Companies. As the state controls the board membership of NOCs investors may possess weaker shareholder influence compared to IOCs. Some of the biggest NOCs must access international capital markets to finance their domestic investment projects and debt refinancing as well as pay oil revenues to governments yet these international investors now demand ESG compliance from them. Changes in financing conditions for NOCs pose

serious risks to their home countries because these enterprises can be viewed as too large to fail while investors demand ESG compliance from NOCs. The financial world now shows signs of repercussions affecting ESG-index performance of NOCs and their shareholder governments including exclusion from such indexes. ESG factors may begin to influence both capital distribution decisions and investment and divestment choices made by NOCs.

The ESG evaluation methods applied to International Oil Companies affect their national oil company partners mostly through partnership relationships between them. Companies which monitor IOCs must assess the ESG practices operating through their non-operating assets as well. In joint venture partnerships between major oil companies and national oil companies from emerging markets non-operated assets are properties in which the major oil company holds equity positions without operator responsibilities.

The International Energy Agency has determined that IOCs operate directly 10 million barrels per day but their investment interest in oil-producing operations expands their influence to 30 million barrels per day.

Public Share listing for National Oil Companies requires these firms to fulfill reporting duties that match those of regular public businesses. The majority of National Oil Companies choosing domestic stock market listings have extended their share registration strategy to foreign financial markets. Global financial centers implementing more stringent ESG regulations will create equivalent reporting obligations for National Oil Companies that affect them similarly to Independent Oil Companies.

In a nutshell, the growing significance of ESG is becoming more and more evident and it is high time that all companies, particularly those in the oil sector take strong and meaningful action towards the same.

Geopolitical Dynamics

The Russia-Ukraine Crisis

In recent times, the Russia-Ukraine crisis, which escalated in 2022, has had a significant effect on the global oil industry. Russia is one of the largest oil producers, therefore its geopolitical actions have had a long lasting effect on the global oil supply chain, oil prices and energy policies world wide. Through this section we aim to explore the dynamics concerning the crisis and its immediate and long-term impact on the oil industry.

Prior to the conflict, Russia served as one of the major oil suppliers in the market worldwide, with major western and European countries depending on it for their economic oil requirements. Russia has nearly 11.3 million barrels per day production, thereby ranking third biggest oil producer preceded only by the United States and Saudi Arabia. Also, Russia was the biggest oil products exporter and the second largest crude oil exporter, reflecting its dominant position in international oil supply.

The Crisis and Its Impact on Oil Supply Chains



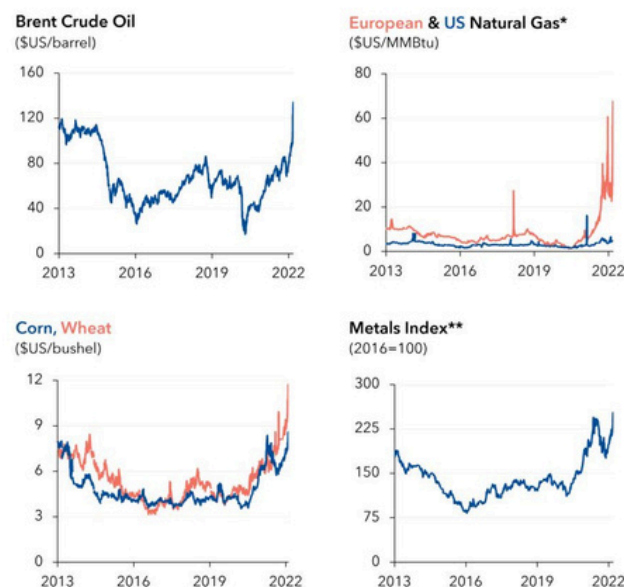
Russia's large-scale invasion of Ukraine in February 2022, was founded on centuries-long

geopolitical tensions between the two nations, leading to widespread political and economic disruption and disruption of the energy sector supply chain. Pipelines that passed through Ukraine acted as a key transit area for energy export to Europe by Russia, which came under Security risks due to the onset of war which was accompanied by financial sanctions and company withdrawals making it difficult for Russia to sell crude oil.

The Russia-Ukraine crisis sent shockwaves throughout the global oil industry, with oil prices surging by \$8 per barrel approximately and Brent crude oil reaching \$100 for the first time since 2014. This spike was further fueled by sanctions of Western Countries in response to Russia's action with the aim of hampering its oil revenue. The measures included a price cap on Russian oil and maritime restrictions for exporting and insurance. To overcome these sanctions, Russia developed a 'shadow fleet' to continue oil export through secretly managed ships and vessels. Investigations uncovered that few individuals like UK accountant John Ormerod and Dubai ship financier Tahir Lakhani made it possible to buy and deal in these ships, allowing Russia to have an uninterrupted supply of oil to the world markets in spite of sanctions.

Growing pressures

Prices for energy, grains, and metals soared since the invasion of Ukraine, signaling that inflation rates are poised to accelerate.



Source: Bloomberg, USDA, Datastream, and IMF staff calculations.
Note: *European & US natural gas prices use the Dutch TTF and Henry Hub as proxies, respectively. **Base Metals Price Index includes aluminum, cobalt, copper, iron ore, lead, molybdenum, nickel, tin, uranium, and zinc.

IMF

1. Shift in Export Destination and Diversification

Though the exports to the European Union plummeted, to the United States, United Kingdom, and OECD Asia declined by 4.3 million barrels per day from pre-war levels, there was a massive increase in exports to India, China, Turkey, and most Middle Eastern countries. This is the resilience in the global oil trade routes in spite of the prevailing geopolitics.

The crisis accelerated the European Union's transition away from dependence on Russian crude oil. In response to this, the European Commission initiated the REPowerEU plan. The plan is intended to promote energy saving, boost clean energy production, and find alternative sources of energy. The EU reduced Russian gas imports by 45% to 15% by 2023, and gas consumption dropped by 18% within two years. The strategy aims at ensuring alternative sources of energy, augmenting LNG imports, and promoting renewable energy ventures. The EU has collaborated with prominent LNG producers

such as the U.S. and Qatar while expanding investments in solar, wind, and hydrogen energy. Even though REPowerEU cut back Russian gas dependence, there are challenges in maintaining energy prices at a stable level and ensuring the sustainable development of energy infrastructure. Political differences between EU member states also influence the implementation of the plan. Some countries are more interested in energy independence, while others are interested in economic stability.



2. Long Term Market Outlook

Analysts project oil prices to stay mostly steady in the next few days, helped by healthy supply and possible solutions to political issues. A Reuters poll projected Brent crude averaging \$74.63 per barrel in 2025, and U.S. crude averaging \$70.66 per barrel. The Organization of the Petroleum Exporting Countries and its partners (OPEC+) possess spare capacity that can rein in potential price spikes, unless there are severe supply reductions. Also, the Russia-Ukraine negotiations might lower oil prices, but we don't know how it will go in the future.

The Global Oil Market Security

The global oil industry is no stranger to the influences of geopolitical factors on not only energy prices but also international security and international trade. The dynamics of the market are shaped by factors like the flow of energy resources, the control of oil reserves and also the stability of major oil producing countries like The United States of America, Saudi Arabia etc. There are multiple political and economic factors, including international sanctions, energy diplomacy, and technological developments that interact to influence these dynamics. In terms of geopolitical risks, tensions in oil rich regions result in supply disruptions which in turn causes major price fluctuations, affecting global market security. At the same time, the recent shift towards renewable resources and technological advancements have reshaped the way oil is produced, consumed and traded all around.

Countries such as those in the Middle East, Russia, and Venezuela hold significant power in the global energy market due to their vast oil reserves. Saudi Arabia, Iraq, and Iran, among other nations, have a critical influence on the global supply of oil, with geopolitical tensions in these areas often leading to significant market volatility. In addition to their abundance of natural resources, these areas are strategically significant because they are situated along vital shipping routes like the Strait of Hormuz, which sees a significant amount of the world's oil commerce. Global oil pricing and supply security are directly impacted by control over such reserves.

The Middle East has for a long time been a star to international energy politics. For example, the U.S.-led invasion of Iraq in 2003 was partially motivated by access to the country's oil reserves. Similar rivalries between oil producing nations contribute heavily to price instability. Conflicts and regional instability in these countries can significantly disrupt the global supply chain, leading to price spikes and insecurity in the global oil market.

While talking about the factors affecting oil market security, sanctions imposed on these oil producing nations cannot be overlooked. These not only affect the nation's economy but also influences global markets. Countries such as Iran and Venezuela, whose economies are highly dependent on oil exports, have faced sanctions that target their oil industries. These sanctions disrupt oil supply chains and cause significant fluctuations in global oil prices. For instance, the U.S. withdrawal from the Joint Comprehensive Plan of Action (JCPOA) with Iran in 2018 resulted in the re-imposition of sanctions on Iranian oil exports, which severely limited its ability to sell oil on the global market. As a result, the global supply of oil was reduced, leading to higher prices and energy insecurity.

As stated earlier, the change towards renewable resources and technological advancements have also changed the manner in which oil is produced and further sold. Governments around the world are shifting their focus on decarbonizing their economies to meet climate change goals. The energy transition, driven by the increasing

adoption of renewable energy sources like wind, solar, and hydroelectric power, is reducing the demand for fossil fuels, including oil. As countries invest in green technologies, oil's role in the global energy mix is expected to decline over time.



Geopolitical risks and Market volatility

Natural disasters, technical failures, and most importantly, political conflicts can disrupt the supply of oil and lead to volatile prices as geopolitical risks continue to be a major source of instability in the oil market. For example, tensions in Strait of Hormuz, a vital shipping route as stated earlier, has the potential to cause disruptions. These geopolitical risks have led to increased calls for energy security strategies, such as the strategic petroleum reserves maintained by countries like The United States of America to mitigate the effects of supply disruptions.



The role of OPEC is crucial in stabilising supply but even their agreements are vulnerable to geopolitical tensions. One instance being the failure of OPEC+ agreement in early 2020 which led to a decline in the oil prices which was made worse by the drop in demand because of the COVID-19 pandemic.



The Future of Oil Market Security

The future of global oil market security will be shaped by both traditional geopolitical factors and the ongoing energy transition. Global energy markets will be increasingly shaped by growing economies like China and India as the demand for oil continues to change. Oil is predicted to remain a vital part of the world's energy mix for the foreseeable future due to these nations' expanding energy needs.

Future Trends

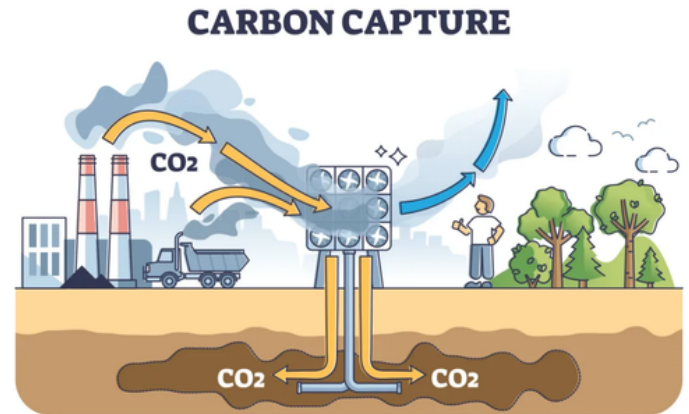
Technological Innovations

Carbon capturing and storage technology

CO₂ is a greenhouse gas emitted from various activities like burning of fossil fuels at a large scale in power plants, household activities, automobile industry and cement production. Excess CO₂ concentration contributes to global warming. The capturing and storing of carbon are the only known technology to reduce GHG emission in astronomical quantities. CCS (carbon capturing and storage) is a method which has evolved as a famous technological innovation involving capturing and concentrating the Carbon Dioxide and then transporting it to a house where it could be stored for a longer time.

1. Capturing CO₂:

As we have established earlier that CO₂ is a by-product of burning fossil fuels at power generation and cement plants. However, power generation is the single major source of carbon emission in terms of quantity. The Carbon capturing and storage technology aligns well with the power generational sources regarding its stable location and bulk size, as compared to the residential and transport sources that are smaller sources of carbon emission. Majorly, there are three sources of capturing CO₂ in the power industry, i.e. capturing CO₂ in post combustion systems, pre-combustion systems and by altering the fuel during its burning process, thereby capturing CO₂ downstream.



2. Transport and storage :

When the capturing part is complete it is to be transported to a storage site or sometimes known as Enhanced Oil Recovery (EOR) fields to be used for further extracting the oil. There are certain requirements for transporting the CO₂ like it needs to be cooled down to -30 degrees Celsius and compressed to higher than 18 bar in liquid form, which is easier for transport. After the captured CO₂ is transported, it must be stored safely so as not to let it out in the atmosphere. The main way of storing CO₂ includes-geological storage, ocean storage and mineral storage.

3. Objective and Application:

CCS is used to curb CO₂ gas accumulation in the atmosphere, which can cause climate change by storing it into geological formations for long-term storage. The captured CO₂ when injected enhances oil production by reducing the viscosity of the oil, making the process of extraction easier. CO₂ can be used as a raw material in various industrial processes like chemical manufacturing or synthetic fuel production.

It can also be used to form stable carbonates which are later used in construction materials. Thus, this CCS technology acts as a bridge between traditional fossil fuel-based energy systems and renewable energy systems.

Biofuels

The need and awareness of biofuel production has been spreading rapidly to address the concerns related to scarcity and petroleum use to help mitigate the global changes in the climate. Biofuels have emerged as a popular and efficient alternative to gasoline and diesel transportation fuels. Four principal fuels that can be manufactured from biomass are ethanol, methanol, biodiesel, and hydrogen. Among these, the leading commercial option has been ethanol which is manufactured from cornstarch and sugarcane in the U.S. and Brazil respectively. Ethanol has been in use majorly in automobiles since the late 1800s. Although the energy density of ethanol is less than gasoline, the fuel can improve thermal efficiency when compared with pure gasoline. But since most of the engines in automobiles do not run on pure ethanol, this potential advantage remains unexploited.

There have been many writings published suggesting the large environmental costs accompanying the expansion in biofuel production and a large loss in food production capacity. A review of 17 studies related to the future global supply of biomass energy speculated land availability and crop production yield as the most critical parameters that are highly uncertain as the large-scale biomass fuel production would divert the heavy demand for land, labour, water, and other related factors. Much of the literature dedicated to biofuels has characterised its efficiency in terms of EROI, energy return on investment, which means the ratio of energy obtained from an activity to energy spent to perform that activity. Standard definitions of efficiency focus on the allocation of the given resources, therefore, a more traditional measure of calculating efficiency is also used that considers the monetary cost competitiveness of biofuels. The question that whether biofuel is solving the problem or just masking the real problem indirectly by posing the environmental challenges related to farming and production still needs to be answered more appropriately with corroborating evidence and technological advances.

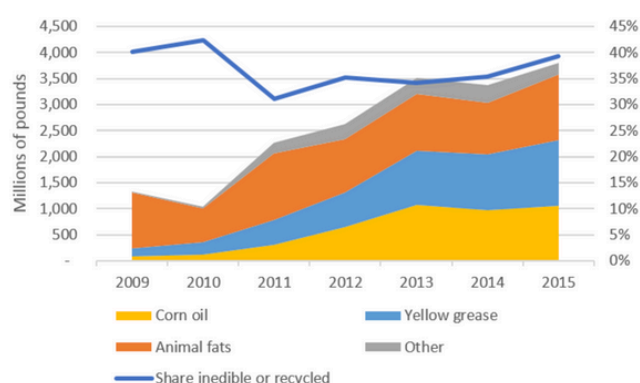


Figure 7. Sources and overall share of biodiesel made from inedible and recycled oils and fats (Source EIA Monthly Biodiesel Production Report)

Saudi Vision 2030

The oil and energy industry stands at the edge, shifting from conventional development plans to embracing the technologies of the future. As discussed briefly in the introduction of this report, Saudi Vision 2030 and the European Union's REPowerEU will play a key role in this shift and will steer the direction of the industry toward its future.

The Saudi economy has been heavily dependent on the oil industry since its discovery on 3 March 1938. The country supplied around 12.8% of the world's crude oil output in 2003 and now it's the second largest supplier in the world after the U.S. Oil revenue has been forming the major share of the country's budget since the 1970s and the 1980s but this comes with a negative side of having the corresponding effect of the industry hit on the overall planning for the economy.

prices fearing the already decreasing country's market share, neither did they succeed in securing cooperation from the non-OPEC members in cutting production which acted as the breakdown for the economy. All these hurdles led the Saudi officials to think for a structural transformation of the country's economy, and then-Deputy Crown Prince Muhammad bin Salman announced the ambitious Saudi Vision 2030. The reforms in this vision intend to bring major changes in the economy by making the citizens the productive workforce while also diversifying the revenue streams for the government to tackle the problems occurring due to over dependence on oil.

The Vision defines some comprehensive structural changes to enhance the country's openness with the world. The vision commits to developing a balance in various sectors, so they equally contribute towards the acceleration of the economy. Vision 2030 steered the country towards a more challenging present for the comforting future. Saudi Arabia looks towards lessening its dependence on oil and is developing a more reliable and resilient structure in the fields of non-oil sectors that includes mining, tourism, logistics and manufacturing. The government is offering incentives and is inviting foreign investment to set up more sustainable grounds of development. With the vision 2030 in force, the production and export of petroleum and oil products will decrease widening the gap between the demand and supply. But the decrease in oil activity is to be supplemented with a strong impetus towards greener and sustainable energy

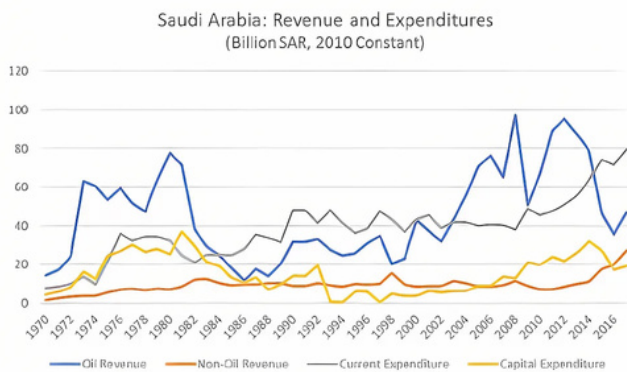


Figure 2. Sources of revenue and forms of expenditure in Saudi Arabia in constant Saudi riyals. Saudi Arabian Monetary Authority, 2018.

The differences in the actual and planned revenue and expenditure also reflects the volatility in the Saudi budgeting plans due to heavy reliance on oil. By late 2014, the oil market underwent a brutal slump with prices plunging down to \$50 by the end of the year. Saudi leaders turned away from the strategy of production cut to boost

production in the region to satisfy the energy needs and prevent crisis.

Key notes about the Plan

The outlines of Vision 2030 include floating a small stake in Saudi Aramco, creating the world's largest sovereign wealth fund to invest across diverse assets, increasing job opportunities for women, and boosting non-oil industries like mining and military hardware. These are bold moves for a country where 90% of revenue comes from oil. The plan to sell a 5% stake in Saudi Aramco is aimed at transforming it into a global industrial powerhouse. But it's not just about the sale, the proceeds, along with the business itself, would be funneled into the Public Investment Fund (PIF), potentially worth \$3 trillion, setting up a massive stream of non-oil investment income.

To make this happen, Saudi Arabia needs to open to foreign investment, embrace transparency, and ease some of its rigid laws. But these shifts won't sit well with the country's conservative groups.

A closer look at Vision 2030 raises doubts about whether it will truly deliver. The biggest gap is human capital development. The Saudi economy has long relied on oil wealth to sustain its people, and that mindset is tough to change. Over 10 million foreign workers handle most of the country's labour and hiring a Saudi national costs four times more than hiring a foreigner. Social norms add another layer of resistance—women still face restrictions like the ban on driving, and many traditionalists oppose their participation in key roles.



The government acknowledges these challenges in Vision 2030 and recognises that improving education is critical for meaningful diversification. But the reality is, Saudi Arabia still has a long way to go before its education system reaches developed-world standards. And until that gap is closed, reducing oil dependence will remain a battle to win.

Despite the challenges, Saudi reforms stay highly attractive to investors. However, the massive "transformation" budgets, amounting to around \$71 billion for related programmes starting this year, may not yield the results the government has planned. Ultimately, the success of these reforms may rest on the prince himself, who has gained immense control over policymaking since his 80-year-old father ascended the throne last year. Saudi Arabia has promised economic diversification for decades—the prince must prove that this time is different. Adding to the uncertainty is the growing rift between Saudi Arabia and the United States. For over half a century, Saudi leaders maintained close ties with the Americans—fuelling their oil dependency, financing their wars, and buying billions of dollars in US-made weapons. But the geopolitical landscape is shifting now.

Norway's Energy Strategy

Norway is an extraordinary exception in the global energy blend, reconciling its past role as a leading oil and gas producer with a total commitment to sustainability and renewable energy. To project ahead to 2050, it is important to understand the trajectory of Norway's oil sector by looking at its history, today, and tomorrow.

Since the discovery of the oil in the late 1960s, Norway has become the biggest oil and gas exporter in the world. The economy is controlled by oil that contributes significantly to gross domestic product (GDP), jobs, and welfare contribution to society. The profits have been carefully controlled and the earnings come into the Government Pension Fund Global for economic stability of the nation in the long term.

The Paradox of Renewable Energy

Apart from its fossil fuel energy source, Norway has also encouraged renewable energy initiatives. Mostly, almost 98% of electricity generated from domestic sources is from renewable energy, a large percentage of which is from hydropower. This is a positive indication of Norway's dedication to green projects and is used as an inspiration by other countries in clean energy endeavors. Such a dual role—being among the principal fossil fuel exporters and a leading renewable energy industry simultaneously—has been controversial with regard to the country's role in addressing global climate change.

Trends in Production and Investment

The past few years have seen unprecedented development in Norway's petroleum and gas sector:

1. **Investment Boom:** Investment in Norwegian oil and gas projects for 2024 amounted to a record high of 256.1 billion crowns (\$22.9 billion). This is because of cost inflation and new projects coming on stream, as a testament to the industry attempting to keep the production levels of the coming decades.
2. **Strategic Realignments by Equinor:** Norway's state-owned energy giant Equinor has shifted its strategy. It will boost its oil and gas production to around 2.2 million barrels of oil equivalent per day in 2030. Meanwhile, it has reduced its projected investments in renewable energy because of offshore wind complexity and a value-creation emphasis.

Future Outlook

Looking forward to 2050, one of these drivers will mold Norway's oil industry:

1. **Resource Exploration and Development:** As its offshore fields naturally decline, Norway's oil regulator has called on operators to step up exploration activity, particularly in out-of-the-way areas like the Barents Sea. The pressure is required to discover new reservoirs that will ensure production levels and economic contribution.
2. **Global Energy Transition:** The faster and quicker global transition towards renewable energy is challenge and opportunity in one

package. As the world shifts away from fossil fuel, demand for oil and gas is bound to persist in some parts of the world. If Norway is or is not to adapt to this new world would be one of the key determinants of the future sustainability of Norway's oil industry.

3. Technological Innovation: Enhanced extraction technology, carbon capture and storage (CCS), and digitalization can enhance the efficiency and environmental performance of oil activities. Research and development emphasis by Norway will be crucial to maintaining its competitive edge in a decarbonizing world.

4. Policy and Regulatory Regimes: International and domestic climate policy will have long-term implications for Norway's oil industry business environment. Domestic and international climate regimes will be a delicate balancing act with implications for exploration, production, and emissions control.

Economic Interests and Environmental Responsibilities

The Norwegian vision for its oil economy in 2050 will most probably be characterized by a determined trade-off between economic ambition and environmental accountability. The nation's wealth, in part based on oil and gas, has funded the cover for renewables and climate policy. But with the remainder of the world under increasing pressure to minimize carbon, Norway is attracted to have to decide on the size and scope of its oil and gas operation in the future.

As 2050 draws near, Norway is at a crossroads. Whether its ability to balance its oil economy with its green ambitions will lock in its economic destiny, and serve as a model for nations to come, is yet to be determined. With wise investments, cutting-edge technology, and prudent policymaking, Norway can make sure that it will be an energy power in a new world order.

New Alliances of the Oil industry

The global economy today feels substantial influence from the oil industry because it provides the essential energy needed for industrial activities as well as transportation systems and electricity generation. Oil remains a leading power source because industries consume billions of barrels annually while ongoing renewable energy development efforts expand. Various internal and external changing factors have initiated meaningful changes across the sector.

Price volatility affects the oil industry as a leading problem because it reacts to shifts in global supply and demand as well as economic cycles and geopolitical occurrences. Companies face mounting regulatory constraints that focus on dual goals of emission reduction and sustainability advancement. Modern governments implement environmental policies which require oil companies to implement cleaner technology methods that direct them into low-carbon energy alternatives.

Strategic Alliances: A Key Driver of Growth in the Oil Industry

The changing business environment leads oil companies toward forming strategic alliances to adapt better. This collaborative approach helps organizations reach new growth levels and security targets and market flexibility. The oil industry sees alliances between companies

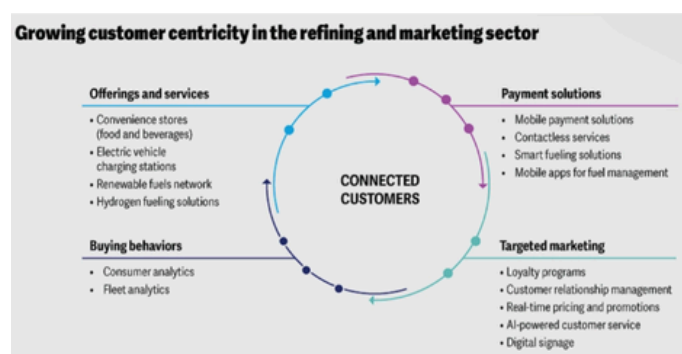
through multiple forms such as mergers, acquisitions, joint ventures and technology firm and renewable energy provider partnerships becoming essential drivers of industry development and innovation.

The importance of strategic alliances within the oil industry grew substantially during recent years after they played their essential role from the beginning. Industrial competitiveness is now evolving toward strategic alliances which work together toward technological advancement and resource maximization and worldwide market penetration. Multiple strategic alliances operate in the oil industry to fulfill unique business objectives.

Collaborative partnerships involve two or more businesses working together to build projects, share infrastructure, or search for new oil sources. These collaborations enhance operational effectiveness and lower financial risks. For example, international oil firms and national oil companies (NOCs) often collaborate to extract oil from deposits in politically sensitive or technically difficult areas. Mergers and acquisitions are another form of strategic alliance, where oil companies merge or acquire competitors to strengthen their market position and gain access to new technologies, markets, or resources. Major players such as ExxonMobil and Chevron have engaged in acquisitions to consolidate their influence in the industry.

Technology and digitalization partnerships are also becoming increasingly important.

Oil companies are forming alliances with tech firms to drive innovation. The integration of artificial intelligence, blockchain, and automation is improving production efficiency, reducing operational costs, and enhancing safety in offshore and onshore drilling operations. These strategic alliances offer numerous benefits, including risk reduction, cost-sharing, access to new technologies, and market expansion. Companies that leverage alliances effectively can not only strengthen their position in the traditional oil market but also gain a foothold in emerging energy sectors.



Future Prospects and Challenges in a Changing Energy Landscape

New alliances within the oil industry create multiple growth prospects. The industry faces fundamental changes because these opportunities refine its performance while providing better access to undeveloped resources and new income sources. Leading oil companies can expect substantial growth through their adoption of digital transformation in the rapidly advancing oil industry. Exclusive alliances with technological companies enable oil firms to boost operational performance by implementing artificial intelligence and big data analytics and machine learning solutions. Through predictive

maintenance powered by artificial intelligence businesses can stop equipment failures before they happen to decrease operational disorders along with related expenses. The use of blockchain technology accomplishes supply chain transparency by providing secure trading capabilities and improved logistics management. BP alongside Shell and other companies are said to have massively invested in digitalization to boost their operational efficiency and revenue growth.

New alliances are also enabling oil companies to expand into emerging markets, particularly in regions rich in untapped oil reserves. Africa, Latin America, and parts of Asia hold significant potential for oil exploration and production, and partnerships with local firms or governments are facilitating market entry. For instance, TotalEnergies has formed multiple alliances with African nations to develop offshore oil fields, while Saudi Aramco has been investing in refining and petrochemical projects in India and China. These alliances provide companies with access to valuable resources while also contributing to economic development in the host countries.

As the world transitions to a low-carbon economy, oil companies are forging alliances to develop sustainable energy solutions. The demand for cleaner fuels, carbon capture technologies, and renewable energy sources is driving collaborations between traditional oil firms and renewable energy providers. A notable example is the partnership between BP and Ørsted, a leading renewable energy company, to develop green hydrogen projects. Similarly,

ExxonMobil and Chevron are investing in carbon capture and storage (CCS) technologies, aiming to reduce their carbon footprint while maintaining profitability. These alliances allow oil companies to remain competitive in a rapidly changing energy landscape while meeting regulatory and environmental requirements.

Infrastructure and supply chain efficiency are critical factors in the oil industry's success. Strategic alliances are enabling companies to develop and enhance oil refineries, transportation networks, and storage facilities. Cross-border partnerships between oil-producing nations are also leading to improved pipeline networks and LNG (liquefied natural gas) terminals, ensuring a more stable and efficient supply chain. For example, the Trans-Adriatic Pipeline (TAP), a collaboration between multiple international energy firms, has improved Europe's access to natural gas from Azerbaijan. This project has strengthened energy security while reducing dependence on traditional oil suppliers. Such infrastructure alliances contribute to cost reductions and increased market accessibility.

- **Challenges:** While new alliances present significant growth opportunities, they also come with a set of challenges. Oil alliances often involve multiple stakeholders across different countries, each with its own regulatory framework. Geopolitical tensions, trade restrictions, and environmental regulations can complicate agreements and delay project execution. Additionally, while digital transformation offers substantial benefits, integrating new technologies into traditional oil operations requires significant

investment and expertise. Companies must navigate cybersecurity risks, workforce training, and system compatibility issues.

- **State of the global economy:** The confluence of easing monetary policies amid global slowdown fears, rising geopolitical tensions impacting financial markets and energy trade flows, and the shaping of energy policies following the 2024 elections in more than 70 nations could make 2025 a pivotal year for the global economy and energy markets. Analysts project oil prices to hover between US\$70/bbl and US\$80/bbl in 2025, with a potential uplift of US\$10/bbl if geopolitical tensions escalate.
- **Investment environment:** This projected state of the economy is expected to create a cautiously optimistic investment environment for the industry in 2025. Companies will likely embrace strategic capital allocation to high-return projects and technological innovation as their strategy. Analysts project a modest 0.5% yearly increase in the industry's capital investment in 2025.
- **Probable actions by companies:** Oil and gas companies are likely to stick to their existing playbook of maintaining capital discipline and shareholder payouts, focusing on technology-driven productivity and cost savings, attaining synergies from their recently completed acquisitions, and managing risk through diversification and integration.

Macroeconomic environment	↑	Geopolitics	↓	Regulatory environment	↓
US Fed is projected to reduce interest rates by nearly 100 bps in 2025	↑ ↑	Middle East conflicts could keep oil prices volatile in the first half of 2025	↓ ↓	More than 25 countries will hold elections in 2025	↔
Deloitte's latest economic outlook shows 1.5% growth in real GDP in 2025	↑	Supply chain disruptions are likely to widen price differential between crude grades	↓	New environmental regulations in major markets	↓
China's stimulus to support its economic GDP growth to 4.8% in 2025	↑	OPEC+ spare capacity of 5.1 MMbbl/d provides some cushion	↑	Increasing tariffs aimed at boosting competitiveness of domestic industries	↓

The oil industry remains highly sensitive to market fluctuations. Unexpected changes in demand, driven by economic downturns or policy shifts, can impact the profitability of alliances.

Additionally, competition from renewable energy sources is gradually shifting the market dynamics. Despite these challenges, companies that strategically form alliances and adapt to the evolving energy landscape will be better positioned for long-term success. The future of the oil industry will likely witness more cross-industry collaborations, with a strong emphasis on digitalization, environmental sustainability, and energy diversification.

Conclusion

The global oil industry has developed significantly over time, influencing economies and international politics. Industrialization has benefited from oil in a significant manner but has also instigated economic and political matters, including the 1970s oil shocks. The success of OPEC shifted the decision-making power with respect to prices into the oil-producing nations, whereas the oil shale boom shook supply fundamentals internationally, making America a world-level producer and rebalancing the market stability.

Later there was the green agenda and finding cleaner sources of energy. Now the industry is being transformed. Governments and businesses are both on a path toward net-zero carbon emissions, advocating the use of renewable energy sources, and tougher laws to keep carbon emissions lower. Investments are going into solar, wind power, and hydrogen power as the world looks to cleaner alternatives than fossil fuel. All this in spite of technological innovation such as carbon capture, digitalization, and improved oil recovery technology provide new fronts to green energy and make the industry more efficient.

Geopolitics also influences the oil industry greatly. The Russia-Ukraine war has affected global energy markets, leading to price volatility

and energy security issues. Countries are trying to reduce sole dependency on suppliers and diversify energy sources. Saudi Arabia is diversifying into petroleum-independent sectors under its Vision 2030 initiative, and Norway is balancing oil with sustainability by investing in renewable energy and strategizing its sovereign wealth fund for future stability.

Financially, the sector is exposed but not without opportunities. Those firms who invest in more environmentally friendly technology and renewable energies can compete ahead. New relationships between energy players, oil suppliers, and technological firms are leading the sector through transformation, urging cooperation and innovativeness so that future security and sustainability can be ensured from energy.

In a nutshell, the oil sector is at a crossroads. There are challenges, from environmental to political, but there are also possibilities of growth through innovation and diversification. Those firms and countries that adapt will be poised for sustained prosperity in the new world energy order.

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