

Oil and Gas Upstream Sector:

Changes of Major Players and the Market across the Ages*

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Introduction

According to Dr. Yuval Noah Harari's bestseller "Sapiens: A Brief History of Humankind," the modern humans known as Homo sapiens emerged 200,000 years ago after human ancestors appeared 2.0 million to 2.5 million years ago on the earth that was formed 4.5 billion years ago. Dr. Harari argues that Homo sapiens have developed through three important revolutions based on their unique capacity to believe in things existing purely in the imagination and their cognitive capacity for fiction.

- The first one, the Cognitive Revolution, kickstarted about 70,000 years ago through which Homo sapiens came to form social groups with the capacity to share fictions such as languages and primitive religions.
- The second one, the Agricultural Revolution, began about 10,000 years ago when Homo sapiens began to devote themselves to agriculture, forming settled social groups through farming and later creating fictions like currencies, empires and religions (ideologies), as well as universal order.
- The third one, the Scientific Revolution, came some 500 years ago as the greatest engine to use science not only for researching but for making constant progress on social, political and economic systems such as national sovereignty states, democracy, and financial and investment mechanisms toward present maturity. In 500 years from 1500, global population has increased 14-fold, production 240-fold and energy consumption 115-fold.

The 500 years after the Scientific Revolution could be subdivided into two by the first industrial revolution in the second half of the 18th century, in which the United Kingdom took the lead with the emergence and improvement of steam engine technology, and the energy revolution of coal use as a power source which is considered to be the biggest historical turning point. Fossil fuels have replaced natural energies like firewood, human labor, animal power, hydropower and wind since then and have been regarded as the main energy source to develop human economies and social infrastructure, paving ways for enhancing living standards, affordability of population growth and seeding capitalist economies and democracy,

Coal was the first fossil fuel to be applied to replace natural energies at the initial stage of the industrial revolution. As industrialization has shifted from light industries to heavy industries, such transportation means as railway trains and steam ships and automobiles have developed utilizing fossil fuels. Almost a hundred years later, in the second half of the 19th century, the leading role of primary energy shifted to oil, which is easier and more convenient to handle than coal.

The rapid development of the heavy and chemical industry owing to technological innovations and the energy transition to oil between the late 19th century and the early 20th century could be called the second

* This paper is an English translation of the articles published in the July and September 2019 issues of Japan Society Energy and Resources, with permission from the Society.

industrial revolution. The relatively smooth energy transition to oil is apparently attributable to two factors. First, oil and gas exploration grew more active in various areas of the world, leading to the discovery of good enough deposits sufficient to meet energy demand that was diversifying and rapidly expanding. Second, continued technological innovations at the oil production, transportation and sales stages allowed oil to sustain its cost competitiveness and economic rationality suitable for the best primary energy source.

The time span of about 270 years of coal utilization since the first industrial revolution or that of more than 160 years after the emergence of oil industry in the United States accounts for only a tiny portion of the 200,000 year-long history of Homo sapiens. However, in only one and a half centuries, various players have energetically tried to become dominant in their business and control the market by making full use of Homo sapiens' given capability to create, believe in and share fictions. This is because oil and natural gas, originating from the same source of hydrocarbon, are not only key primary energy sources important to humans' economic and social infrastructure but also a strategic commodity indispensable for national security. This paper reviews the chronological changes of major players and the market in some 160 years since the emergence of the oil and gas industry in the second half of the 19th century and explores future prospects in a manner to take lessons from the past.

1. Second half of 19th century

Table 1 shows major oil-producing countries' crude oil production trend between 1860 and 1930. **Figure 1** represents a historical crude oil price trend from 1861 to 2018 presented in BP Statistical Review of World Energy 2019. In the second half of the 19th century, when the oil business began as an emerging industry, history was looked back on, mainly in the United States and Russia, which led the industry.

Table 1. Major oil-producing countries' production trend (1860-1930)

Source: World Oil

Units: 1,000 barrels/% per year	U.S.		Mexico		Russia/USSR		Dutch East Indies (Indonesia)		Global total
	Production	Share	Production	Share	Production	Share	Production	Share	Production
1860	500	98	-	-	-	-	-	-	509
1870	5,261	91	-	-	204	4	-	-	5,799
1880	26,286	88	-	-	3,001	10	-	-	30,018
1885	21,859	59	-	-	13,925	38	-	-	36,765
1890	45,824	60	-	-	28,691	37	-	-	76,633
1895	52,892	51	-	-	46,140	44	1,216	1	103,692
1900	63,621	43	-	-	75,780	51	2,253	2	149,137
1905	134,717	63	251	0	54,960	26	7,850	4	215,091
1910	209,557	64	3,634	1	70,337	21	11,031	3	327,763
1915	281,104	65	32,911	8	68,548	16	11,920	3	432,033
1920	442,929	64	157,069	23	25,430	4	17,529	3	688,884
1925	763,743	71	115,515	11	52,448	5	21,422	2	1,068,933
1930	898,011	64	39,530	3	125,555	9	41,729	3	1,410,037

Crude oil prices 1861-2018
 US dollars per barrel
 World events

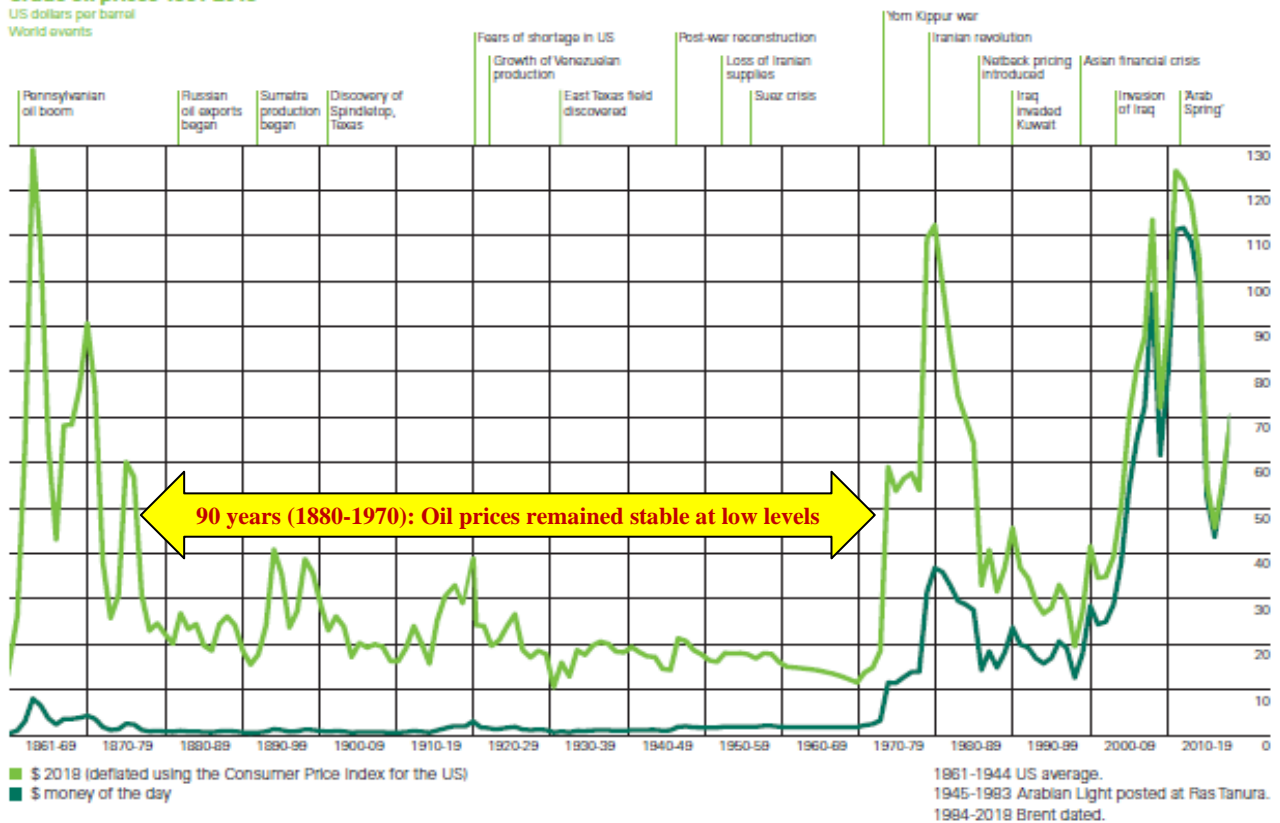


Figure 1 Crude oil Prices 1861-2018

Source: BP Statistical Review of World Energy 2019

1.-1) U.S.

In the 1850s, late in the Edo period, when the Tokugawa Shogunate was running about in confusion due to Commodore Matthew Perry's arrival, lamps using whale oil began to be used in Japan. At that time in the U.S., the oil industry was born because black oil used as a drug by Native Americans, once refined and processed, was found more suitable for lighting application for lamps. In August 1859, Edwin Drake successfully drilled the first mechanized oil well in the Oil Creek valley near Titusville in Pennsylvania, triggering an unprecedented oil investment boom as new entrants rushed into the oil field development one after another throughout the country. Oil prices reportedly plunged from a peak of \$20 per barrel to \$0.1/bbl in 1861 because of oversupply from new production while demand at that time was only limited to lamp and lubricant oil.

John D. Rockefeller, who started an oil refining business in Cleveland, Ohio in 1863, founded Standard Oil Company of Ohio (SOHIO) in 1870, using an oligopoly and trusted financial methods of oil refining by taking control of transportation measures such as railways, as the U.S. oil industry entered a realignment and survival period due to oversupply. In less than a decade, he built a monopoly on the oil refining sector and markets in Pennsylvania, as well as Texas and California, across the United States. Firstly, Rockefeller employed a price-cutting offensive and excluded or acquired competitors to become the largest oil refiner in Cleveland that accounted for a quarter of total U.S. oil refining capacity. He then expanded his corporate acquisitions into East Coast oil refining centers New York and Pennsylvania and took control of sales companies in the southern state of Texas to further expand his business. Rockefeller also acquired transportation means energetically, taking control of most U.S. railway tankers and three-quarters of trunk pipelines by 1876. By 1880, he came to capture 90-95% of U.S. petroleum products sales. In 1882,

Rockefeller formed Standard Oil Trust to control his expanded, diversified conglomerate. Standard Oil Trust controlled about 40 companies including 14 wholly owned subsidiaries such as Standard Oil of New Jersey (the predecessor of Exxon), Standard Oil of New York (which later merged with Vacuum Oil, another firm under the Standard Oil Trust umbrella, into the predecessor of Mobil) and Standard Oil of California (the predecessor of Chevron). Standard Oil Trust then launched international expansion, entering European and South American markets.

1.-2) Russia

Major oil producers in the second half of the 19th century were the United States, Romania and Russia's Caucasian region.

Russian crude oil production, totaled only 0.2 million barrels in 1870, rapidly expanded from the mid-1870s and reached 29 million barrels in 1890 (**Table 1**). Russian lamp oil appeared in the European market for the first time in 1883 and fast spread there, competing with U.S. lamp oil in 17 countries in 1887. Behind the fast spread were Sweden's Robert & Ludwig Nobel (who later created the Nobel Prize) and France's Rothschilds family.

The Nobel brothers built a refinery in the Russian oil-rich region of Baku in 1875 and founded the Nobel Brothers Petroleum Production Co. to launch oil production. In 1888, the company accounted for one-third of Russian lamp oil production. The Rothschilds acquired an oil concession in Baku in exchange for loans to the Batum railway before founding Caspian and Black Sea Petroleum (nicknamed Bnito from its Russian-language name). Bnito signed up with many small oil refiners to become the largest exporter of Russian lamp oil and develop sales networks in Europe. In the second half of the 1880s, it expanded into the oriental market.

In a bid to export Russian lamp oil to the oriental market, British trader Marcus Samuel in 1891 signed a 10-year exclusive distributorship agreement for Russian lamp oil with the Rothschilds who controlled Bnito. In 1897, the British trader founded Shell Transport and Trading Company to expand oil business.

The remarkable Russian oil industry development boosted Russian lamp oil's global market share from 3% in 1884 to 22% in 1889, while the share for U.S. lamp oil fell from 97% to 78%. Russian lamp oil thus became an unignorable rival for U.S. lamp oil.

1.-3) Asia

The Netherlands' Royal Dutch Petroleum, founded in 1890, built a refinery in Pangkalan Brandan to refine crude oil produced on the east coast of Sumatra as part of the Dutch East Indies (now Indonesia), launching lamp oil exports in 1892. Its export business to Asia and Oceania (Singapore, the Malay Peninsula, Japan, China, the East Indies and Australia) became competitive to the rival U.S. exporter in several years. Since then, the three-way market battle between Royal Dutch Petroleum, Standard Oil of the U.S. and Shell of the United Kingdom has intensified.

Shell was negotiating a partnership with both Standard Oil and Royal Dutch in parallel, but in December 1901, it suspended talks with Standard Oil, agreed in principle to partner with Royal Dutch, and signed the so-called British-Dutch Agreement. This agreement was not enough to stop their sales competition in the Asian market. In June 1903, however, the Rothschilds that provided Russian kerosene (lamp oil) into the Asian market joined the British-Dutch group to create a new joint venture, Asiatic Petroleum Co., of which stakes the three equally owned. In 1907, Royal Dutch and Shell merged into Royal Dutch Shell Group (hereinafter referred to as Shell). The terms of the merger gave 60% ownership of the new group to the Dutch arm and 40% to the British. Asiatic was integrated into the new group.

2. First half of 20th century

The oil industry at the beginning of the 20th century was dominated by Standard Oil Group who dominantly controlled U.S. oil resources and Shell Group based on oil resources in Southeast Asia.

2.-1) Anti-trust law and Standard Oil breakup

In the United States in the early 20th century, new demand for oil emerged; one such demand was for gasoline as Ford Motor invented and developed a gasoline-based Model T Engine and started selling Model T cars in 1908, and another was for heating oil for stove fuel. Driven by the surge in oil demand, Standard Oil grew more and more. In the second half of the 19th century in the United States, monopolies formed under the free competition policies; however, the presence of big monopolies came to bar newcomers and led to a number of situations in which free competition was hindered. In response, the U.S. Congress recognized the need for regulating monopolies and passed the Sherman Act as the first U.S. anti-trust law in 1890. (Furthermore, the Clayton Act and the Federal Trade Commission Act were enacted in 1914 to enhance the Sherman Act. The three acts are collectively called Anti-Trust Law.)

As of 1904, Standard Oil controlled 91% of U.S. domestic crude oil production and 85% of retail oil products sales and exported 55% of oil products (mostly lamp oil) to various parts of the world. In 1909, the Justice Department sued Standard Oil for violating the Sherman Act. On May 15, 1911, a Federal Court ruled to break Standard Oil up into 34 regional companies.

2.-2) Dominance of Seven Majors (Seven Sisters)

In the 1910s, spinoffs from the Standard Oil breakup began to compete with each other and focused on expanding sales in foreign countries where military oil demand increased due to World War I. During the war between 1914 and 1918, aircraft, tanks and fuel oil-powered ships flourished, leading the world to recognize oil as a strategically important good. After the Ottoman Empire was defeated in the war and broke up, the United Kingdom approached the newly born Turkey as well as Iraq that had been under Ottoman control, triggering an oil exploration boom in the Middle East. The winners in the Middle Eastern oil-drilling concessions were Standard Oil spinoffs, as well as British and Dutch companies that had successfully drilled oil in their colonies. Among the spinoffs of the Standard Oil Group holding company, three entities later grew into international oil majors, including Standard Oil Company of California (Socal, the predecessor of Chevron), Standard Oil Company of New York (the predecessor of Mobil and ExxonMobil) and Standard Oil Company of New Jersey (the predecessor of Exxon and ExxonMobil).

In 1908, the Briton William Knox D'Arcy discovered the first oilfield in Persia (now Iran). Based on the oilfield, Anglo-Persian Oil Company (the prototype of BP) was founded in 1909. In the United States, oilfields were discovered one after another in Texas and California, leading to the founding of Texas Fuel Company (renamed Texas Oil Company in 1903, the predecessor of Texaco) in 1901 and that of Gulf Oil Corporation in 1907.

In this way, five U.S. international oil majors – Exxon, Mobil and Socal that originated from Standard Oil, and Texaco and Gulf that grew through an oil boom in the southern and western U.S. – and two European international oil majors – Royal Dutch Shell and Anglo-Persian (BP) – came to dominated the world's oil industry in the beginning of the 20th century, ushering in the age of Seven Sisters (**Figure 2**).



Figure 2 Logos of seven international oil majors (Seven Sisters)

From 1900 to 1950, oil production in oil-producing countries other than the United States and the former Soviet Union was mainly based on comprehensive concession contracts awarded to the Seven Sisters and other European and U.S. large oil companies. Oil companies granted extensive concessions had exclusive or monopolistic rights to do oil business in the host countries over a long term (usually more than 50 years). Although these oil companies were required, under the contract, to pay tiny royalties to them, the governments of oil-producing countries had no room to intervene in their business operations. The Seven Sisters cartel devised various pricing mechanisms to protect their rights such as the Gulf-plus pricing system and Middle East plus system in order to maintain centralized control over oil prices in the world.

The Seven Sisters took advantage of every means to secure their oil exploration and development concessions and maintain or expand their market shares. They also tried to create de facto standards to prevent their status from being threatened. In a representative case, Standard Oil NJ, Shell and Anglo-Persian signed the Achnacarry Agreement to fix their respective oil sales shares in former Ottoman Empire territories outside the United States at the 1928 levels. Anglo-Persian, Shell and Standard Oil NJ/NY also signed the Redline Agreement under British, U.S. and French government approval to prohibit independent oil development in former Ottoman Turkish Empire territories and require participants in Turkish Petroleum Co. (renamed Iraq Petroleum Co. in 1929) to share oil concessions and operations.

The age of Seven Sisters lasted until the 1970s. As of 1949 after World War II, the Seven Sisters were said to be owned concessions accounting for 65% of global oil production and 43% of global oil deposits, dominating the oil global industry.

2.-3) Sign of resource nationalism --

Given that global crude oil supply sources concentrated in the Middle East after World War II and that major oil consumers such as Europe and Japan began to refine crude oil on their own, international oil majors enhanced joint venture and other arrangements to jointly control large-scale oil resources in the Middle East and other oil-producing regions.

Saudi Arabian oil resources were initially put under control by Arabian American Oil Company (Aramco), a joint venture between Socal and Texaco, before Standard Oil NJ and Standard Oil NY invested in Aramco in 1947. In this way, four U.S. international oil majors came to control Saudi oil resources. Iranian oil resources were owned by the Iranian Consortium including European and U.S. international oil majors from 1954 following a conflict over the nationalization of Anglo-Iranian Oil in 1951, as will be described later.

In Mexico (see **Table 1**) where some U.S. and European oil companies including Shell engaged in commercial oil production from around 1901, a constitution was established in 1917 to materialize the cause of the Mexican Revolution, providing for a land reform, workers' rights and national sovereignty over underground resources. Under the constitution, the then Cardenas administration in 1938 implemented the nationalization of oil resources and ousted foreign oil companies, first in the world. (In 2014, the Mexican oil

sector was opened to foreign companies for the first time in 76 years.)

Venezuela, then more advanced than other oil-producing countries, became the first country to introduce an income tax system for oil companies' payments to an oil-producing country government. The country enacted the income tax system for the oil industry from 1943 and established a value added tax in 1948 to implement a profit-sharing scheme to ensure that 50% of oil business profit would become government revenue. Saudi Arabia, dissatisfied with oil companies' low royalty payments to the government, adopted a new concession sharing mechanism in 1950 to almost quadruple its oil revenue. Iraq and Kuwait followed this in a similar manner.

The introduction of income tax and other systems required changes on these countries' domestic laws (for income tax payments). As oil export prices per barrel (on a realized price basis) were required to be posted for calculating income subject to taxation, the posted price system of crude oil was introduced.

In 1951 when the income tax system was being generalized, Iran's Muhammad Mossadegh regime nationalized Anglo-Iranian Oil that had monopolized its oil industry. Sazo Idemitsu of Idemitsu Kosan Co. who was the model for a novel titled "Kaizoku to yobareta Otoko (A Man called Pirate)," cause a stir and successfully imported Iranian crude oil from the Mossadegh regime in 1953 using their own tanker "NISSHO MARU," which was quite a frightening event for European and U.S. international oil majors claiming their exclusive rights to Iranian oil. The nationalization eventually ended up as a failure in the face of direct and indirect resistance from international oil majors and their countries. In 1954 after Mossadegh's ouster, the nationalization impasse ended as Iranian Consortium, which was owned 40% by five U.S. international oil majors and 60% by British Petroleum (BP), Shell, France's CFP and the United States' Irikon, signed a contract work agreement with Iran.

3. Second half of 20th century

In the second half of the 20th century, the upstream oil and gas sector evolved into a global business targeting not only onshore underground but offshore waters in various areas of the world, in response to the dramatic growth of energy demand derived from the rapid increase of global population and industrial evolutions. Since 1950, every 10 to 15 years, cyclical upturns and downturns of the oil industry could be recognized that would bring major structural changes in the oil market and transitions in key players.

3.-1) 1950s and 1960s: Postwar structural market changes – Middle East replacing U.S. as world's largest oil supplier

The United States, the world's largest oil exporter before the end of World War II, turned to be a net importer of crude oil and petroleum products from 1948 (**Figure 3**). On the other hand, the Middle East, of which crude oil production was still less than Venezuela accounting for 12% of the global production in 1948, came to account for around 20% at around 1953 and increased its importance as a crude oil supplier. The Middle East's share of oil imports into Western Europe, a major oil consumer, exceeded 50% soon after the war and rapidly expanded to more than 80% by 1958.

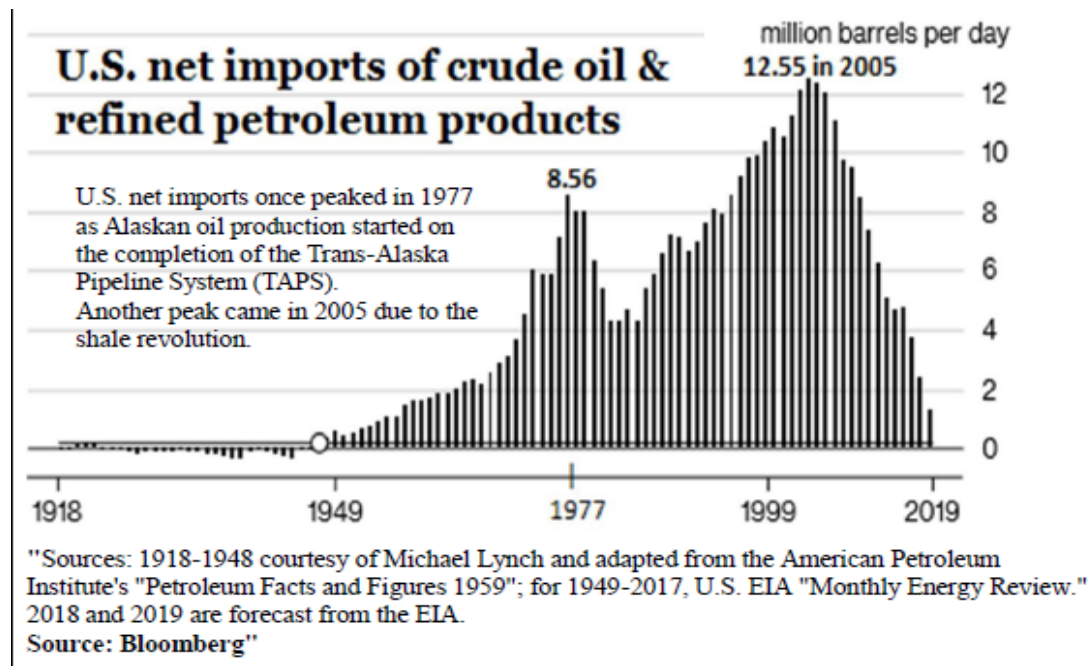


Figure 3: U.S. oil supply-demand balance

3.-2) 1960s and 1970s: OPEC's rise and market dominance – End of low and stable oil prices

The Seven Sisters lowered the posted price, which is the basis for calculating income taxes paid to oil-producing countries, in both 1959 and 1960, reflecting a general downward trend of realized prices in the market. Oil-producing countries felt a sense of crisis about the risk of oil revenue drops through the posted price cut and recognized the need for defensive measures against the risk.

In September 1960, oil exporters Iraq, Iran, Kuwait, Saudi Arabia and Venezuela held a meeting in the Iraqi capital of Baghdad and agreed to create the Organization of the Petroleum Exporting Countries (OPEC), which was joined later by other oil-producing countries like Qatar, Indonesia, Libya, the United Arab Emirates, Algeria and Nigeria. Through a permanent agency aimed at regular consultations among the participating members, the OPEC oil-producing countries, who have covered most of government revenue solely dependent on payments from international oil majors to which they granted oil concessions, gradually implemented measures to take back oil pricing rights and concessions from the Seven Sisters and other foreign firms.

In the 1960s, energy demand continued to increase thanks to robust growth of the global economy, while surplus production capacity increased due to the development of new large oil fields, and crude oil prices continued to fall lower due to oversupply. While posted prices for the Middle East crude oils were held at 1960 levels due to OPEC resistance, dissatisfaction among OPEC countries was growing. In May 1970, the Libyan revolutionary government, an emerging oil-producing country that defeated the monarchy in a bloodless coup by Capt. Gaddafi and others, launched a hard line on raising oil prices (the posted price plus \$0.3-0.4/bbl premium), triggering an OPEC price offensive.

OPEC countries succeeded in signing the Tehran agreement with international oil majors in February 1971, the Tripoli agreement in April 1971, the Geneva agreement in January 1972 and the new Geneva agreement in June 1973, winning posted oil price hikes, income tax rate hikes and adjustments to the dollar's depreciation. Following the further price-raising offensive sparked by the fourth Middle East war of 1973 and the first oil crisis, the Seven Sisters completely lost their oil pricing rights to OPEC countries, ending the period of low and stable oil prices that lasted for about a century from the mid-1870s.

After the fourth Middle East War broke out on October 6, 1973, six Persian Gulf countries among the OPEC

oil-producing countries announced to raise their posted crude oil price by 70% from \$3.01/bbl to \$5.12/bbl on October 16. On October 17, the Organization of Arab Petroleum Exporting Countries (OAPEC) decided to phase down crude oil production. From October 20, OAPEC countries decided one after another to impose an oil embargo on the United States, the Netherlands and other Israel supporters until Israel pulls out of the occupied Arab territories. On December 23, six Persian Gulf countries among the OPEC members decided to increase their posted oil price by 127.5% from \$5.12/bbl to \$11.65/bbl in January 1974. In response to these moves, the United States in principle banned the export of domestic crude oil in 1975 as a precaution against social unrest and energy shortages over OPEC's growing influence (and lifted the ban in December 2015).

With regard to the recapture of oil interests from international oil majors, there were two patterns for the governments of oil-producing country to take: in the first (moderate) pattern, they participated in oil business operations as partners of concession-holding contractors aimed at gradually expanding control. In the second (radical) pattern, they directly and quickly took back resources and business concessions from concession-holding international oil majors in the form of nationalization.

The Riyadh Agreement signed by Saudi Arabia and Abu Dhabi in December 1972 with international oil majors is a prime example of the first pattern case.

The second pattern or nationalization was seen in Algeria (1967), Libya (1970), Iraq (1972), Venezuela (1976) and Iran (1979), but the process and the form of the oil industry after nationalization varied by country.

3.-3) Second half of 1970s to mid-1980s: Waning OPEC power -- Loosening oil supply-demand balance and emergence of futures market

Two major changes have occurred on the other side of OPEC's continued high oil price policy, shielding the strength of its members' cohesion and the superiority of supply and market share. One was a decline in oil demand, and the other was a surge in crude oil production in non-OPEC oil producing countries.

The first oil crisis (1973) triggered by Arab oil-producing countries' actions using oil as a weapon prompted industrial countries to recognize the need for their forum to discuss policy coordination among developed countries in macroeconomics, energy, currency, and trade policy and launched their annual summit meeting in 1975. At the Tokyo summit that came amid the second oil crisis triggered by the 1979 Iranian revolution, seven industrial countries resolved to hold down oil consumption, set oil import targets and promote the development of alternative energy sources. At the Venice summit in June 1980, they resolved to set targets for lowering oil's share of primary energy supply.

In addition, on the supply side, there were dramatic changes that would drive back the decline and sluggish demand for oil. OPEC's policy of keeping oil prices high artificially strongly supported investment in high-cost polar and deep-sea oil development and the commercialization of small oilfields. Alaska's Prudhoe Bay oilfield launched production in 1977, followed by full-blown North Sea oil development in the 1980s.

Furthermore, oil trading markets were formed from the late 1970s in addition to the conventional oil market dominated by self-contained physical transactions between oil-producing countries and international oil majors as sellers and oil-consuming country governments and end-users as buyers. Initially, parties to oil transactions used barter-type location swaps and time swaps of oil physicals to cut transportation costs and adjust the supply-demand balance to their mutual advantage. Later, however, brokers, as well as traders who took risks and conducted proprietary trading, entered the oil market. Public commodity exchanges and private over-the-counter markets were rapidly developed to handle futures and options in addition to physicals and forwards. In 1983, the New York Mercantile Exchange (NYMEX), a public exchange, listed West Texas Intermediate crude oil futures contracts, which have become an oil price benchmark. (New York

Harbor No. 2 Heating Oil contracts became the first oil futures to be listed on NYMEX in 1978.) Subsequently, the International Petroleum Exchange (IPE) in London listed North Sea Brent crude oil futures contracts. Since then, the commoditization and financialization of oil accelerated, leading to the development of markets where oil producers, users, traders and other oil industry players could enjoy hedging functions against price fluctuations at their own risk and responsibility. In this way, oil pricing rights were transferred from international oil majors and OPEC to the invisible hands of markets including futures exchanges.

As a result, global oil demand turned downward as shown in **Table 2**, leading to oversupply. Some OPEC countries had no choice but to voluntarily cut production, and OPEC's share and market dominance weakened.

International oil majors that had lost oil pricing rights to OPEC were forced by the Iranian Revolution to lose exclusive concessions that they had defended under the rule of Shah Mohammed Reza Pahlavi since the formation of the Iranian Consortium in 1954. As the new Iranian regime after the revolution expanded direct dealings and spot sales with consumers, international oil majors' influence declined decisively after the second oil crisis.

Table 2 Changes in global primary energy demand, oil demand and OPEC supply after 2nd oil crisis

(Unit: million tons of oil equivalent) Source: BP Statistical Review 2019		1973 1st oil crisis	Change	1979 2nd oil crisis	Change	1985
Primary energy demand (A)		5,662.7	+1,021.5	6,684.2	+469.9	7,154.1
Oil (B)	Share: (B)/(A)	49.8%	▲2.1%	47.7%	▲7.2%	40.5%
	Demand	2,819.2	+367.8	3,187.0	▲289.1	2,897.9
OPEC (C)	Share: (C)/(B)	53.3%	▲6.4%	46.9%	▲19.9%	27.0%
	Supply	1,503.2	▲8.4	1,494.8	▲713.7	781.1

To briefly look back at the situation of Saudi Arabia, the leader of OPEC and the world's largest oil producer:

- (1) Saudi Arabian crude oil production in 1983 was halved from more than 10 million barrels per day in 1980 and 1981 as Saudi Arabia lost some of its market share to other OPEC members and non-OPEC oil-producing countries. In 1985, production plunged to 3.6 million bpd.
- (2) Saudi Arabia cut its official sales price of Arabian Light crude oil from \$34/bbl in October 1981 to \$30/bbl in February 1983 in its first ever oil price reduction. It lowered the price further to \$29/bbl in February 1983 and to \$28/bbl in February 1985 (**Figure 4**).
- (3) As its oil revenue declined steeply due to production and price cuts, however, Saudi Arabia became unable to organize its budget. In July 1985, Saudi Arabia declared that it would no longer serve as a swing producer to adjust the crude oil supply-demand balance. In October of the same year, it launched the net-back pricing system to base crude oil prices on market prices of petroleum products in oil-consuming countries, before expanding production soon.

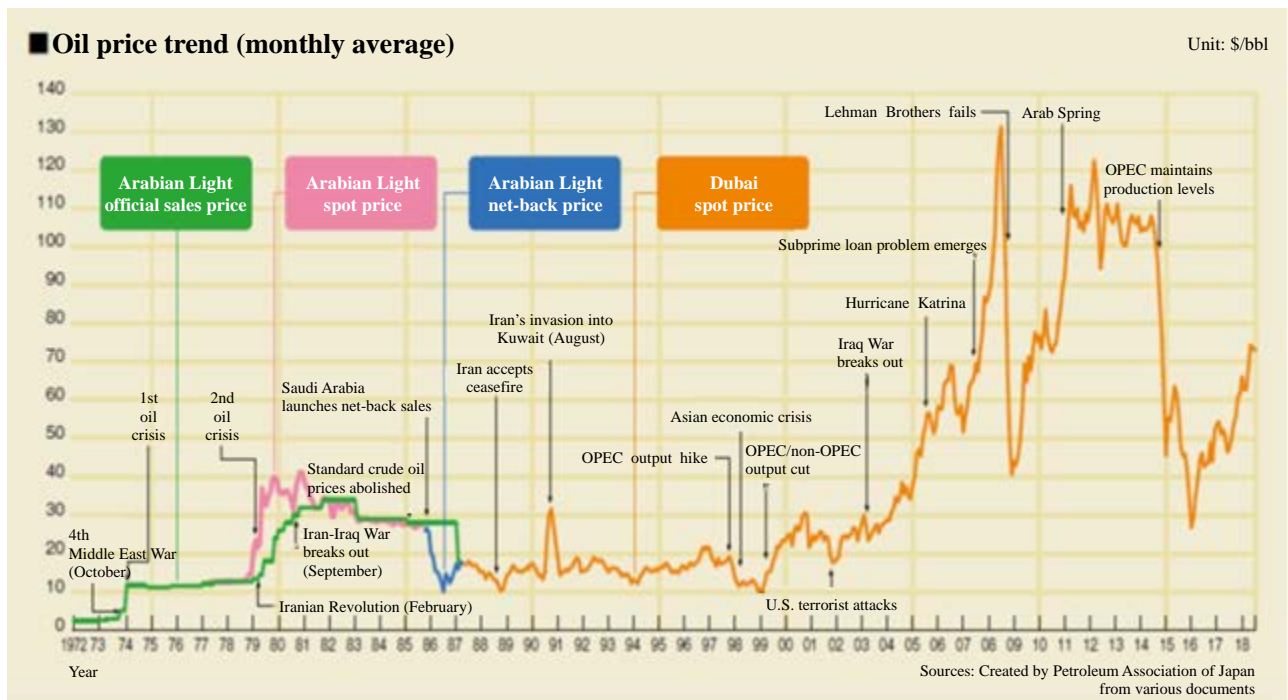


Figure 4 Crude oil price trend (1972-2018)

Source: Petroleum Association of Japan, “Today’s Oil Industry 2018”

3.-4) 1986 to 1990s: Market-based pricing – Progressing oil commoditization

Saudi Arabia’s adoption of the net-back pricing system featured the epoch-making introduction of market principles into crude oil pricing. The Saudi Arabian policy turnaround allowed Saudi crude to recover its market share in the global downturn market but led to heavy price drops simultaneously. The spot North Sea Brent price plunged from \$30/bbl in November 1985 to less than \$20/bbl at the end of January 1986 and to \$9.50/bbl in July of the same year.

Feeling a stronger sense of crisis, OPEC enhanced oil production cuts and called on non-OPEC oil-producing countries to join the production cuts in July 1986. Within and outside OPEC, calls grew gradually for stabilizing crude oil prices by adopting a fixed-price system.

In December 1986, OPEC decided to revive the fixed-price system on January 1, 1987, setting the weighted average of Arabian Light and six other crude oil brands at \$18/bbl. It also set a production quota at 15.8 million bpd for the first half of 1987 and a tentative quota for the second half. From the beginning of 1988, OPEC began to adopt a spot price indexation system to index term contract prices to spot prices of specific crude oil brands. In the autumn of 1988, this system covered almost 80% of term contracts.

Since Saudi Arabia discontinued serving as a swing producer in the second half of the 1980s, oil has intensified its commoditization tendency to leave pricing to market principles and market “invisible hands.” Throughout the 1990s, oil supply and demand fundamentals that form the backbone of market principles remained bearish, exerting downward pressure on oil prices, excluding the Persian Gulf Crisis period between August 1990 and March 1991 when a temporary market surge took place by such series of events as Iraq’s invasion into Kuwait, the United Nations resolution tolerating armed attacks on Iraq, allied bombing on Iraq and the Gulf War ceasefire agreement. The Asian economic crisis, triggered by the currency plunge in Asia in July 1997, had a further impact on oil demand, and the oil market fell to a 12-year low in February 1999, the first time since the price crash in 1986 (Figure 4).

Since we Homo sapiens, who have evolved with the unique capability to believe in things existing purely in

the imagination, the cognitive capacity for fiction, listed fictitious WTI futures contracts on NYMEX in 1983, the oil trading in the virtual market has grown rapidly and commoditization of the oil market has made great progress. The fictitious oil futures market that globally operates 24 hours a day like stock, bond and currency markets has been steadily developed, reflecting the supply and demand position and market principles of the real economy in principle, and it has grown to become an essential part of the pricing mechanism for oil and natural gas.

4. Late 20th century to present

Starting with a major industry restructuring drama from the end of “the Century of Oil,” the oil industry has recovered from a long-running market downturn cycle. Then, the surge in demand in emerging economies such as China and the shale revolution in the U.S. have created a high oil paradise for nearly 10 years. As the market has shifted into a downward cycle since 2014, the oil and gas market has become more diversified and quantitatively expanded by attracting non-oil related new players such as investment funds, and transformed into a more liquid and volatile market.

4.-1) Late 1990s to mid-2000s: Realignment of IOCs – Escape from a long downturn cycle

As the downturn cycle has been prolonged for more than a decade, it was IOCs (International Oil Companies) that raised a sense of crisis over OPEC and NOCs (National Oil Companies).

They were well aware that to stay in the status quo would lead to a decline and that losers should immediately exit and keenly felt the need to make a bold reform. A drastic and unprecedented oil industry realignment including mergers and acquisitions between oil majors came between 1998 and the early 2000s. It was British Petroleum that took the lead.

- In December 1998, British Petroleum acquired Amoco for \$55 billion and renamed itself as BP Amoco Plc.
- In September 1999, TotalFina acquired Elf for €2.6 billion in France and renamed itself as Total.
- In November 1999, Exxon acquired Mobil for \$82 billion and renamed itself as ExxonMobil.
- In April 2000, BP Amoco acquired ARCO for \$27 billion. (The U.S. Federal Trade Commission (FTC) approved the acquisition after ARCO spun off ARCO Alaska and sold it to Phillips for \$7 billion.)
- In September 2001, Chevron acquired Texaco for \$39.5 billion, as approved by the FTC.
- In August 2002, a merger between Conoco and Phillips into ConocoPhillips was approved by their shareholders and the FTC. The merged company’s market capitalization totaled \$18 billion.
- In August 2005, Chevron acquired Unocal for \$17.9 billion. (After Chevron offered \$16.5 billion for Unocal in April, China’s CNOOC made a counteroffer of \$18.5 billion in June. However, the U.S. Congress opposed the Chinese company’s acquisition of Unocal for national security reasons.)
- In December 2005, ConocoPhillips acquired Burlington Resources Inc. for \$33.8 billion.
- In October 2007 in Norway, Statoil annexed the oil and gas division of Hydro. (In 2018, Statoil renamed itself as Equinor.)

IOCs including oil majors materialized these big M&A deals boldly in a chain reaction to survive deteriorating business conditions through structural market changes and prolonged oil price stagnation. The realignment deals were generally designed to rationalize operations and enhance financial strength through upsizing and cost cuts and maintain or improve technological capabilities and stock prices. As both acquirers and acquirees were strongly alarmed about how to survive, these deals were cut through relatively short negotiations. As a result of the realignment, the Seven Sisters that had dominated the global oil market until the early 1970s were integrated into four groups – ExxonMobil, Royal Dutch Shell, Chevron and BP.

4.-2) Mid-2000s to early 2014: Rapid oil demand growth in China and other emerging economies -- Burgeoning U.S. shale revolution

Soon after achieving a long-held desire to accede to the World Trade Organization (WTO) and join the market economy, China rapidly expanded oil and gas imports required for “the factory of the world” and rushed into overseas operations to secure oil and gas resources. (China took 15 years to realize its entry into the WTO after filing an application.) Other emerging market economies also expanded oil and gas demand for their remarkable economic growth from around 2002, allowing the 15-year sluggish downturn cycle to end. Competition for oil and gas resources as well as coal and uranium emerged in the upstream sector. In the midstream and downstream sectors, global distribution flow began to structurally change. In addition to changes in supply and demand fundamentals driven by new oil demand, the 2003 Iraq War, Hurricane Katrina in 2005 and other factors interrupting stable oil supply came to usher in a high oil price period, when the spot Dubai crude oil price made a paradigm jump from \$50/bbl to \$70/bbl and to more than \$100/bbl, as shown in **Figure 4**.

In 2008, the collapse of the housing bubble and the subprime loan problem sparked the collapse of Lehman Brothers, the fourth largest investment bank in the United States, triggered the global simultaneous recession that forced oil prices to plunge below \$40/bbl (Dubai sank to \$33.55/bbl). However, oil demand remained robust in China and other emerging market economies. Furthermore, amid a sharp decline in stock prices and a sharp fall in the currency following the Lehman shock, "wandering money" which grew due to liquidity enhancement measures taken by governments from around the world flooded the energy market as the safest and high-return investment target, encouraging oil prices to quickly spike back. With the massive influx of "wandering surplus money" into shale businesses in the United States, oil and gas fields development and LNG projects in various regions, investment decisions for various projects based on the assumption of sustained high oil prices have been realized.

In the energy commodity futures markets featuring high volatility and liquidity, the market environment has become more diversified and active due to the entry of speculative players such as hedge funds and the expansion of the size of funds. Futures and Options trading on public commodity exchanges such as New York and London are now inflated to tens of times the physical supply and demand volume of the real economy, making it an integral part of the oil pricing mechanism. In three years to 2018, daily average WTI futures trading volume rose to 1.1-1.3 billion barrels, over 10 times more than global crude oil production at about 98 million bpd.

On the supply side as well, a great structural change came in the second half of the 2000s. That is the U.S. shale revolution.

According to BP Statistical Review, the United States, though having turned a net oil importer in 1948, kept its production level above 10 million bbl (including 1.5-2.0 million bpd in natural gas liquids or NGLs) in 18 years of the 1967-1986 period excluding 1976 and 1977 and remained the largest oil producer in the free world (excluding the former Soviet bloc) until it lost the position to Saudi Arabia in 1980. As the depletion of operating oilfields was coupled with constraints on new oil and gas development by social demands to protect the environment and respond to global warming, U.S. oil production declined year by year and slipped below 7 million bpd in 2005. In such situation, technological innovation burgeoned to allow unconventional oil and gas resources trapped in shale layers to be extracted. The innovation produced the core fracturing or fracking technology to inject ultra-high-pressure liquids into rock formations containing shale gas and tight or shale oil to generate artificial fractures and release gas and oil from rock formations with low penetration rates. The advancement of a horizontal drilling technology to widen the exposure of the fractured rock to a well bore and a micro seismic technology to detect progress in fracturing allowed gas and oil collection rates to increase further, triggering an unconventional resource development boom for ground

shale layers where drilling costs are lower.

The shale revolution led U.S. natural gas and crude oil production to rapidly expand as shown in **Figure 5**. U.S. oil production rose back to 7.263 million bpd (including 2 million bpd in NGLs) in 2009 thanks to growing tight oil production. Tight oil production increased further later, accounting for 60% of total U.S. oil production that rose above 15 million bpd (including 4.36 million bpd in NGLs) in 2018. Unconventional shale gas now captures 70% of U.S. natural gas production.

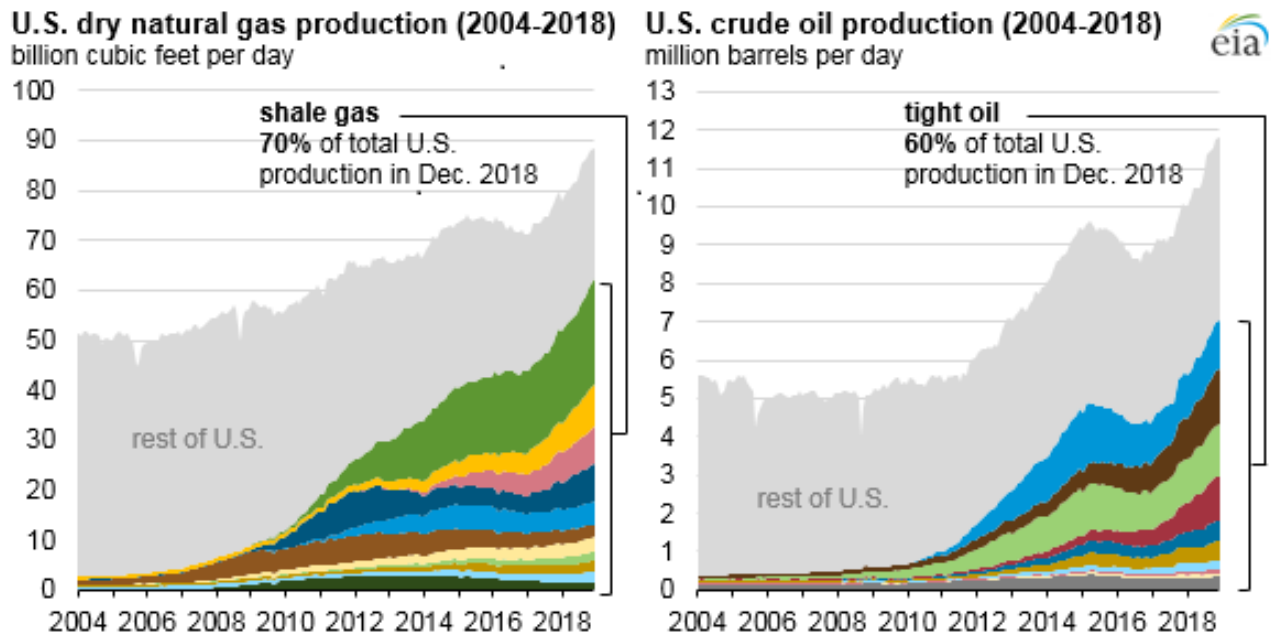


Figure 5 U.S. natural gas and crude oil production trends (2004-2018)

Source: U.S. Energy Information Administration

4.3) Late 2014 to present (2019): Dawn of low-carbon or decarbonized society – Challenging complicated risks

Although the U.S. shale revolution began to exert great influence on the global oil supply structure around 2006, rapid oil demand growth in China and other emerging market economies allowed oil supply and demand in the real economy to rise in a balanced manner, with oil prices remaining high. Wandering surplus money growing since the Lehman failure flew into the oil and gas market, transforming the market into a more volatile one.

China, whose economy has boomed rapidly since joining the WTO, has led the global economy, including aggressively entering resource acquisition competition and overseas asset acquisitions to encourage over-competition and market inflation, but since the beginning of the 2010s, its economic growth has slowed down year after year.

The developed countries were gradually taking off from the aftereffects of the Lehman shock but the energy consumption growth in Western countries and Japan was trivial. The fierce race for natural resources and new oil and gas development investment decisions depended completely on robust oil demand in emerging market economies including BRICs (Brazil, Russia, India and China). However, as economic growth in China and other emerging market economies began to slow down or stagnate, bullish energy demand forecasts were revised substantially downward. In the middle of 2014, excessive crude oil inventories and oversupply surfaced, and the high oil price market, which has continued since the early 2000s, has plummeted.

There have been two patterns of oil market crashes since spot and futures markets were launched in the

1980s. One pattern represents crashes triggered by the 1998 Asian currency crisis and the 2008 Lehman failure. These crashes caused by the financial crises were followed by rallies in a relatively short term. The other pattern represents crashes attributable to weak supply and demand fundamentals, including the current crash as well as the downturn cycle that lasted for more than 10 years from 1986 to the early 2000s. An oil supply-demand imbalance or excess inventories emerged in the autumn of 2014 and lasted until the spring of 2018 when supply and demand were rebalanced once. At an OPEC meeting in July 2019, however, oversupply was feared again, indicating that we are still in a downturn cycle.

As a standard indicating a proper inventory level, OPEC has adopted an average crude oil inventory level for the latest five years in the member countries of the Organization for Economic Cooperation and Development. However, the OECD countries accounted for only 48-49% of global oil demand in the latest five years. We may have to remember that the international community is discussing whether supply and demand are rebalanced or not, based on these developed countries' various dynamic data (that may be evenly accurate and based on even statistical methods) and those provided by China, India and other non-OECD countries that use their respective unique statistical methods.

The current downturn cycle has had a major difference with the previous one. Due to the expansion of both asset and debt in the high oil price environment, a considerable number of IOCs including majors and oil-producing countries have been plagued with overleveraged financials.

In the high oil price environment before the current downturn cycle, NOCs and IOCs boasted of massive cash revenues to easily cover massive capital spending on and loan repayments for ongoing projects. Amid the downturn cycle, however, they have faced an unprecedented situation where they have difficulties in day-to-day cash management as their cash flow has turned negative with heavy losses. They have suspended ongoing projects to save cash spending. Global investment in the upstream oil and gas sector plunged in 2015 and 2016 for the first two-year downturn in 30 years. Investment has turned up since 2017 but remained far below levels before 2014. As operating oil and gas fields are being depleted, the sluggish investment is feared to exert serious negative effects on the future maintenance or expansion of supply capacity.

After investing in the sector aggressively in the high oil price environment, investors and financial institutions have suddenly changed their attitude, mercilessly implementing immediate investment withdrawals, additional security requests and lending quota revisions.

Moreover, rating agencies such as S&P and Moody's have lowered credit ratings for oil-producing countries and IOCs including majors. Credit ratings by these agencies, though only representing opinions on debt repayment capabilities, are significant, objective and influential indicators reflected in lenders' loan decisions and borrowers' fundraising costs. The credit rating cuts soon forced less creditworthy U.S. shale companies to go bankrupt, throwing the oil industry into a survival race.

In a bid to survive as winners, international oil majors have quickly tried to improve their unprecedentedly vulnerable financials by giving top priority to the early restoration of positive free cash flow and balance sheet rebalancing. They have commonly tackled spending saving measures including personnel and cost cuts, capital investment restrictions, business portfolio and investment discipline optimization, selling of non-core assets and revisions to agreements with contractors. However, they have refrained from reducing shareholder returns (dividends and share buybacks).

On this occasion, the majors have also begun to energetically change the way of thinking among executives and regular employees for enhancing organizational strength and tackle digitalization to further improve their technological supremacy. At the same time, they are fiercely competing to transform into corporations that tackle difficult challenges such as global warming, social requirements for low-carbonization and decarbonization, the ESG (environment, society and governance) investment trend and coexistence with core

businesses.

5. Future oil and gas market

As the 21st century opened, an age came for both industrial and developing countries to discuss how to reduce their dependence on fossil fuels, which account for about 80% of primary energy supply, and how to take relevant actions on a global scale. Given the mainstream theory that global warming is attributable mainly to anthropogenic greenhouse gases emitted through human industrial activities, including carbon dioxide that is increasing due mainly to human fossil fuel consumption, fossil fuel phase-out, low-carbonization and decarbonization initiatives have been accelerated in recent years to spread electric vehicles, switch to renewable energy such as solar photovoltaics, wind and biomass and promote energy efficiency improvements.

About 160 years have passed since the oil industry emerged in the United States. About 60 years have passed since oil replaced coal as the main primary energy fuel. The countdown has started for the timing for oil or gas to lose its current position within the coming half century. Oil demand is likely to peak as early as in the 2030s. In view of such business environment, the oil and gas upstream sector may be increasingly required to give greater consideration to environmental risk factors and pivot from the supply side to the demand side (Figure 6).

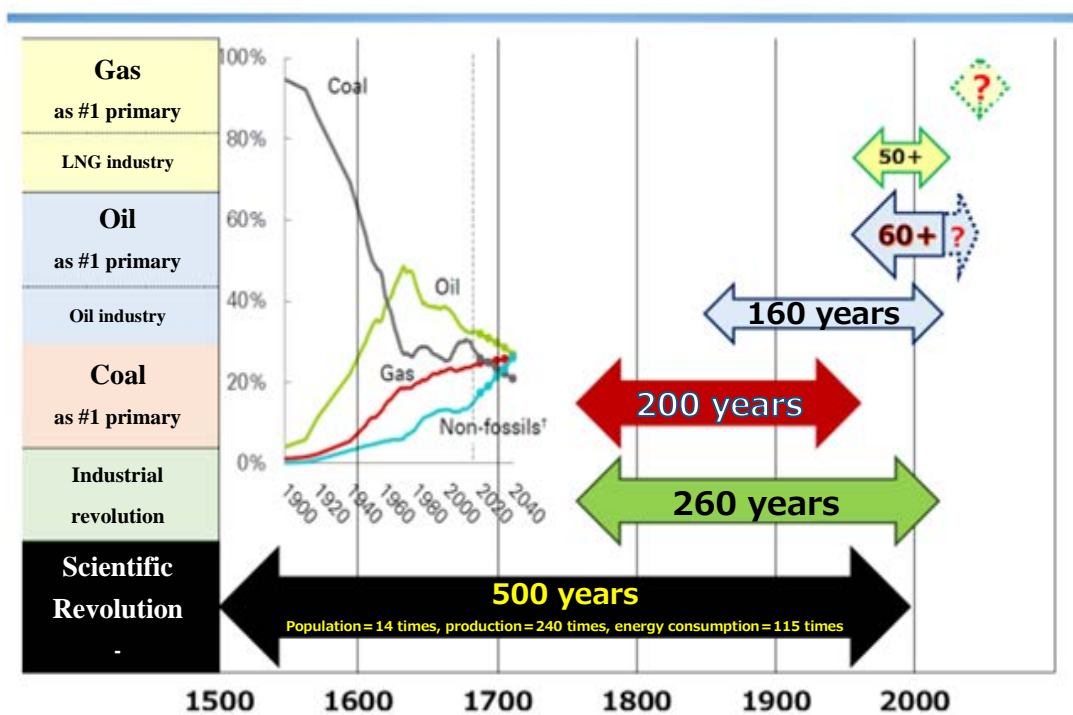


Figure 6 Energy chronology from Scientific Revolution (1500)

Sources: Graph from BP Energy Outlook 2018, table prepared by the author from various information

As discussed later in 5. -2), fossil fuels are indispensable for non-combusted use or raw material application for petrochemical production and the like. Unless alternative raw materials for petrochemicals are found, it would be impossible to realize a world that does not depend on fossil fuels at all. Realistically, the optimum solution would be to explore the best energy mix to minimize the fossil fuel share while expecting energy sources to be further diversified through such technological innovation as artificial intelligence and Internet

of Things technologies.

Lastly, having looked back on the changes of major players and the transitions in the market since the birth of the oil and gas industry, it seems that three notable perspectives in looking ahead have come into view as follows.

5.-1) Gas to become main primary energy fuel

As global warming and environmental protection have been emphasized and closely watched as key global challenges since the end of “the Century of Oil,” demand for natural gas, which has relatively low CO2 emissions, is growing steadily as the primary energy source with the highest advantage among fossil fuels. In its Energy Outlook 2019, BP gives the Evolving Transition reference scenario in which gas demand is projected to increase at an annual rate of 1.7% (against 0.3% for oil and minus 0.1% for coal). Natural gas is predicted to replace coal as the No. 2 primary energy fuel in the mid-2020s and compete for the No. 1 position of primary energy fuel with non-fossil fuels and oil in 2040 (Figure 7). Non-fossil fuels are forecast to post the highest growth in the coming two decades.

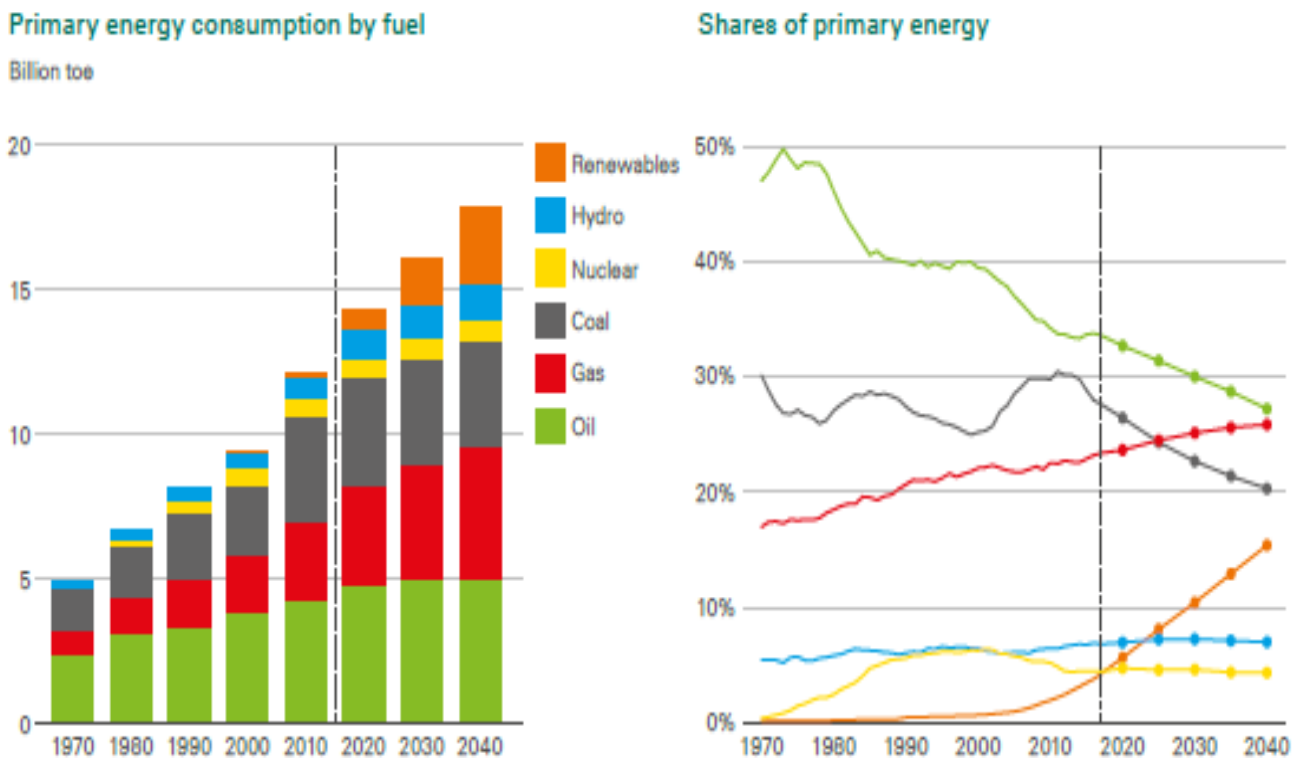


Figure 7 Primary energy consumption by fuel and shares Source: BP Energy Outlook 2018, 2019

While gas demand is expected to sustain growth due to energy demand expansion in emerging market economies accelerating industrialization and fuel switching to gas, supply is projected to rise in the United States, Qatar and Iran. Gas production in 2040 is predicted to increase by nearly 25% in the United States and by 20% each in the Middle East and the Commonwealth of Independent States. In international trade, liquefied natural gas trade is projected to exceed pipeline gas trade in the second half of the 2020s. LNG trade in 2040 is estimated to more than double from the current level to 900 billion cubic meters (660 million tons), accounting for more than 15% of global gas demand.

5.-2) Oil to be focused on non-energy or non-combusted use

BP in its Energy Outlook 2017 reclassified the end-user sector of primary energy demand by creating the “non-combusted use sector” for feedstock usage of fossil fuel in petrochemicals, lubricants, asphalt and tar. Those non-fuel uses had previously been classified in the industry sector. Most of the non-combusted feedstocks are derived from oil, but some belong to gas and coal.

At present, the industry sector (including petrochemicals, etc.) accounts for about 50% of primary energy demand, the buildings sector for 29% and the transport sector for 21%. The transport sector’s energy demand is expected to substantially decelerate growth due to the spread of electric vehicles. In the Evolving Transition scenario, the non-combusted use sector’s demand is projected to increase by 7 million bpd to 22 million bpd in 2040 as demand for oil for petrochemicals expands. This increase is the largest among sectors. That is why the non-combusted use sector was separated from the industry sector (**Figure 8**).

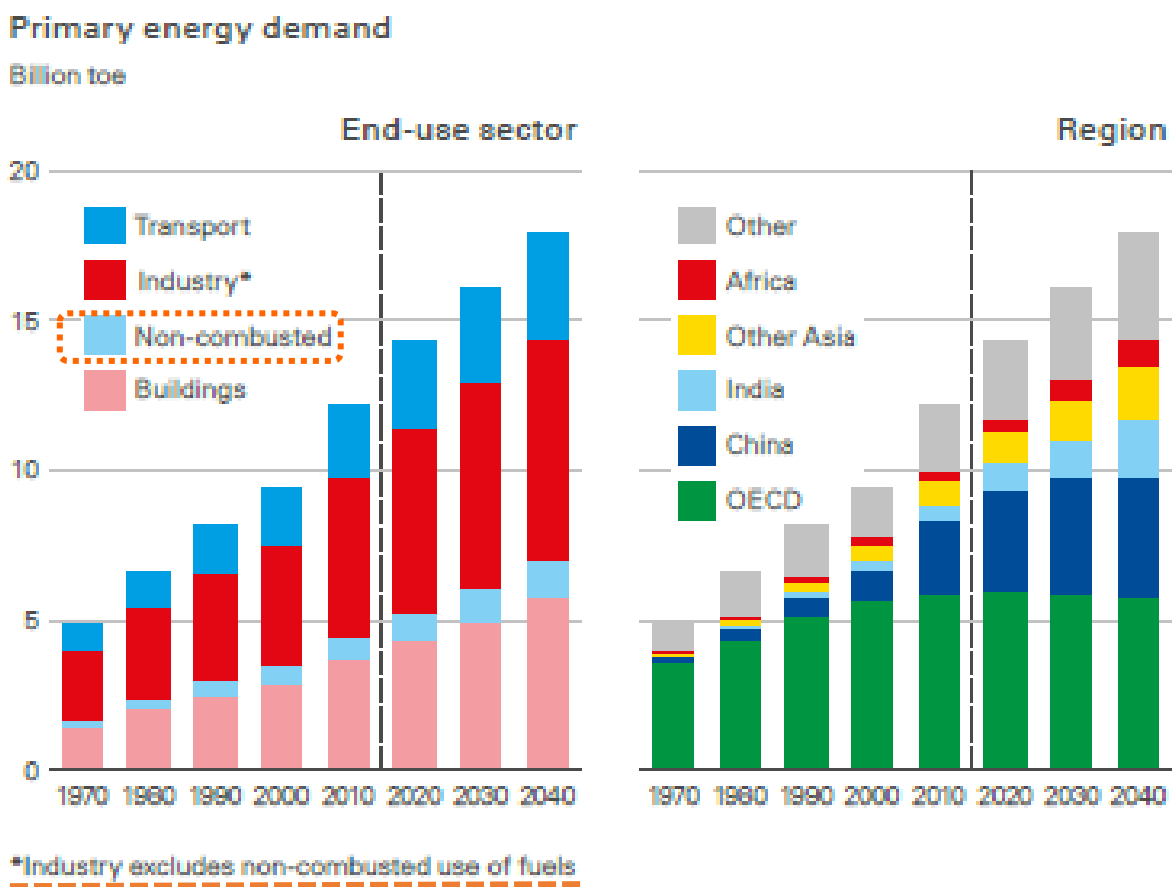


Figure 8 Primary energy demand by end-use sector and region
2019

Source: BP Energy Outlook

5.-3) U.S. regaining supremacy?

Figure 9 is a long-term outlook (an excerpt covering up to 2040) on U.S. crude oil and NGLs production given in the Annual Energy Outlook 2019 released by the U.S. Energy Information Administration in January 2019. In both the Reference Case and Low Oil & Gas Resource + Technology Case, U.S. crude oil and NGLs production is projected to maintain high levels above the present level of 15 million bpd over a long term.

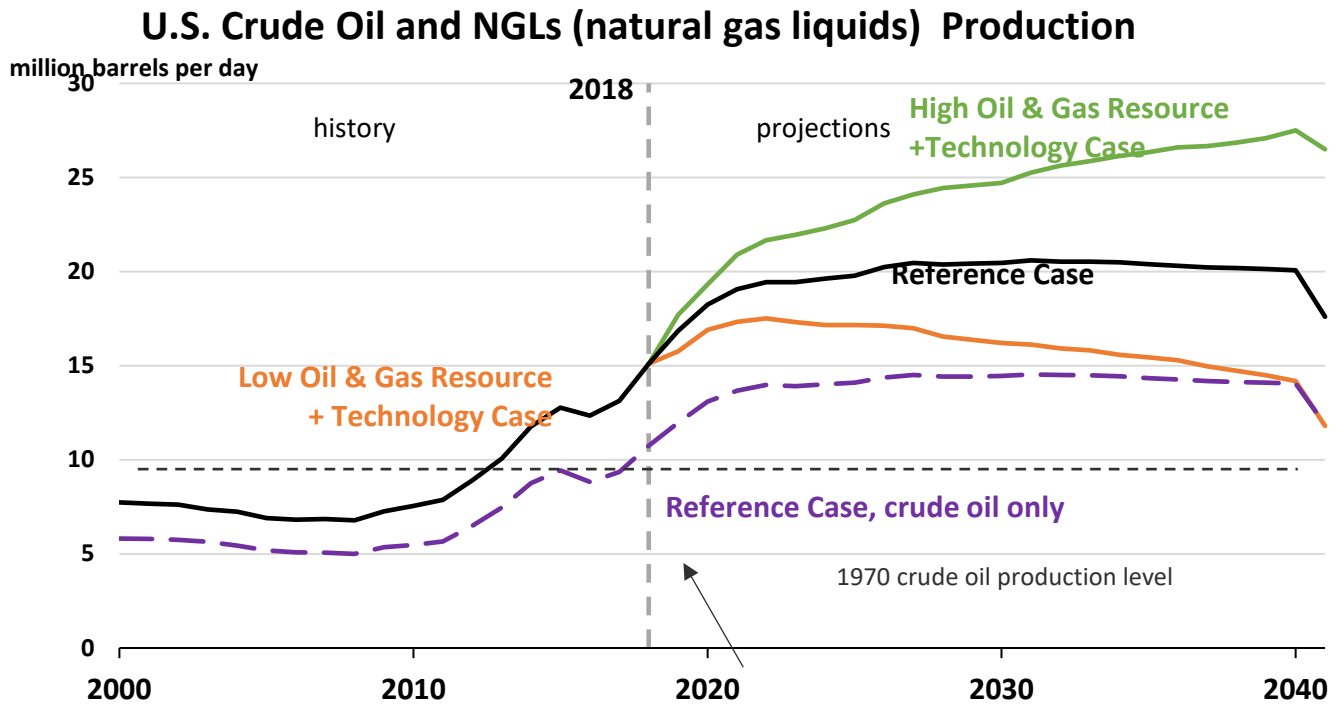


Figure 9 U.S. crude oil and NGLs production results and forecasts (2000-2040)

Source: Energy Information Administration

The United States turned a net oil importer in 1948, banned crude oil exports in principle (light crude oil exports to Canada were exceptionally permitted) in response to energy shortages in 1975 after the first oil crisis and lifted the 40-year ban in December 2015. In several years, the United States is very likely to turn a net oil exporter for the first time in more than 70 years.

The United States became an LNG exporter in 2016 and may replace Australia as the second largest LNG exporter after Qatar in the near future. (Other LNG exporters include Russia and Africa.)

As U.S. oil and gas production is expected to expand further, New York’s trading volume and roles for financial instruments including oil and gas futures and derivatives are likely to increase more and more.

Given the above, the United States is increasingly likely to regain supremacy in the oil and gas industry which emerged in the country in the second half of the 19th century, some 160 years ago.

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