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# THE EFFECTS OF THE DEVELOPMENT OF THE NATURAL GAS INDUSTRY ON THE GLOBAL OIL MARKETS

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**Abstract:**

Global energy markets are witnessing rapid and continuous changes due to the multiplicity of factors affecting them, and these changes have a reflection on energy-related industries, such as the oil, natural gas, and coal industries. Recent attention is focused on the natural gas industry, especially during the past five decades.

Finding a gas well was previously considered a failed and often neglected exploration, while now it is a major achievement because natural gas has taken a leading position in the energy ladder, after oil and coal for its economic properties and environmental This led to an increase in investments in the field of the natural gas industry, and intensified competition between countries to develop this industry and increase its revenues as an alternative to other economic aspects.

The research discusses in a focused way the composition of natural gas and its treatment method, with reference to the advanced technology used, which pushed the development of this industry forward. This had an impact on the oil market, where there is an inverse relationship between the prices of energy sources Natural gas is expected to occupy a leading position during which it will be a successful alternative to oil and these developments will affect the oil markets.

And the relationship has become inverse between the development of the natural gas industry and the oil market because the recovery of the natural gas market leads to a decline in oil prices with the decline in global demand and part of it is directed to natural gas.

It has become important to analyze the economics of the natural gas industry, the quantities of discovered reserves, the future demand for gas, and the quantities of consumption, as natural gas has become a competitor to oil as an alternative source of energy, especially after the increase in the effects of environmental pollution resulting from the use of oil, and it is necessary to determine the effects of developments in the gas industry natural. . In the global oil markets, by addressing the gas industry, its installation, the technology used globally and analyzing the economics of the natural gas industry, to prove the research hypothesis that there is an inverse relationship between the development of the natural gas industry and global oil markets. , because natural gas is one of the competing alternatives to oil, through three main sections.

**Keywords:** Natural Gas Industry, Global Oil Markets, Natural gas markets, Investment, Energy resources, Development.

**INTRODUCTION :** Natural gas, as a source of used energy, possesses a set of advantages, economic characteristics and the environment that have led to an increase in interest in the natural gas industry, and a rise in the volume of investments in this competing oil field. It is noted that natural gas is used in many industries such as the manufacture of fertilizers, petrochemicals, chemicals and other secondary industries, which contribute to raising the added value of investments, and one of the important things that increased the luster of the gas industry is the decrease in the percentage of pollutants when burning, due to the presence of a global trend about Reducing

**World Economics & Finance Bulletin (WEFB)**
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Vol. 42, January, 2025
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environmental pollutants and reducing carbon dioxide emissions that are harmful to life in general and to human health in particular.

In addition to the thermal efficiency that is achieved by igniting gas, therefore, specialists consider it a competitive energy source for oil, which is a challenge for the oil industry, and it has become a driver of global economic growth rates as it contributes (20%) of global primary energy needs, and there are trends to use natural gas as a fuel for many industries and electric power stations, as well as transportation and home use. The gas industry, like other industries, faces challenges and difficulties in its various stages of production, transmission and distribution, the most important of which is the need for high investments.

This research discusses in a focused and brief manner the natural gas industry, the developments that it has witnessed and the reflection of the effects of those developments on the oil markets.

**RESEARCH IMPORTANCE :**

The importance of the research is related to the importance of global energy markets and the variables that they are witnessing, and the research sheds light on an important source and energy sources, its composition and method of processing and the technology used globally, and addressing the economics of natural gas and the role of this by putting pressure on the global oil market.

**RESEARCH PROBLEM :**

The research problem lies in the importance and ability of the natural gas industry to meet the increasing global demand for energy, with the abundance of reserves, in conjunction with the challenges of high economic costs of production, transportation and distribution, and what is the impact on global oil markets.

**SEARCH OBJECTIVE:**

The research aims at the following aspects:

1 - Studying the composition of natural gas and the global technology that contributed to the increase in interest.

2- Analyzing the economics of the natural gas industry in terms of global reserves, demand and future consumption.

3 - Statement of the impact of the development of the natural gas industry on the global oil markets.

**RESEARCH HYPOTHESIS:**

The research assumes that the natural gas industry is developing at an accelerating pace that makes natural gas a competitive and powerful source for other energy sources in general and oil in particular, and the development achieved in the natural gas industry will be reflected in the decline in oil markets because part of the global demand for energy will be directed to natural gas.

**RESEARCH METHODOLOGY :**

The researcher uses the descriptive and analytical method for the data and information available from the official specialized sources >

## The first topic: The natural Gas Industry, Installation, Processing Methods, And Costs

Natural gas is receiving world attention as an important source of energy, as its use has increased in generating electric power, and it has entered as a basic material in many important industries, so it called for focusing on exploration operations, and then increasing global reserves. Increasing production quantities to meet the increasing global demand. Therefore, it is necessary to study the global markets specialized in natural gas in its two forms (liquefied natural gas and pipelines) and to deepen gas pricing, which varies according to markets and their ability to impose a specific price. It is indicated that there are many factors that affect pricing, which determine future demand in world markets. Achieving major global leaps in increasing the importance of natural gas among fossil sources, as well as other sources and through the primary (LPG) technology for the natural gas industry, and then moving to transport and liquefaction with (LNG) technology that helps in exporting a process to distant markets that are difficult to deliver from the pipeline route Pipes and thus the pipeline route is diverted to liquid (GTL) derivatives and hydrocarbon derivatives similar to the use of petroleum derivatives (Clegg, 2004, 9).

First: natural gas composition and properties.

Man has known since prehistoric times about natural gas when it was rising from the cracks of the earth's surface to the top, and then its value and benefits were not known. Louisiana to Texas, and in 1821 the first gas well was drilled in Frodina in New York, and then the pipeline networks were expanded and use increased as the United States in 1980 began importing gas from other countries, while in China natural gas was used before 200 General and it was transported by bamboo cane, noting that the United States used gas since 1800 for lighting, and the Gas Selling Company was established in 1816.

Gas began to be used commercially after World War II, due to the presence of large quantities in the Netherlands, the North Sea and other regions of the world. To that, the former Soviet Union is another producer and consumer of natural gas. (Geller, 2009, 17) Raw Natural Gas consists of different gases, and methane is the main component, which is characterized by the absence of color and odor, and according to the formation theories of fossil fuels, gas

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

is formed from accumulated plankton, and it is similar to the formation of oil and coal through pressure and heat, as Depths are between (1000-6000) meters and temperatures reach 160 degrees Celsius, oil is formed, and with higher temperatures and more depths, gas is formed.

Table (1)
Substances that contribute to the formation of gas

| S | Compound name | Chemical formula | %The percentage in the gas |
|---|---|---|---|
| 1 | methane | CH4 | 90-70 |
| 2 | ethane | $C_2H_6$ | 1-20 |
| 3 | propane | $C_3H_3$ | 1-20 |
| 4 | butane | $C_4H_{10}$ | 1-20 |
| 5 | carbon dioxide | $CO_2$ | 1-8 |
| 6 | Oxygen | $O_2$ | 1-2 |
| 7 | nitrogen | $N_2$ | 1-5 |
| 8 | hydrogen disulfide | $H_2S$ | 1-5 |
| 9 | pungent gases (argon, helium, xenon, neon) | Ar , He, Ne, Xe | 0.1-0.9 |

**Source : John D .podesta and Timothy E. Wirth ,Natural Gas Bridge Fuel for the 21 Century (USA ,center for American Progress ,2009. p63.**

It is noted from the table that gas as a fossil fuel consists of a group of hydrocarbons, such as methane, which constitutes (90-70%), ethane, propane and butane, which constitute (1-20%) and there are other non-hydrocarbon materials such as carbon dioxide and nitrogen. natural properties, including:

A- It is colorless and odorless, and an aromatic substance is added to it to detect leakage for safety.

B - High calorific value, as it is twice the calorific value of conventional fuel when burning. The high degree of combustion, which contributes to raising the power and thermal efficiency of the engines, and the fact that the combustion is complete facilitates the maintenance process and extends its capacity.

C - The speed of ignition and low pollutants compared to other types of fossil fuels, making it a source of thermal energy in electricity and transportation. (Mohammed, 1985, 53)

Natural gas exists in several forms, and the main types can be clarified:

1-Free natural gas, free GAS.

And it is in the form of free gases in pure gas fields, and it is either dry or wet, and it flows due to the pressure of the earth's interior.

2 -Associated gas.

It is attached to the oil or dissolved in it. (Al-Shalji and Jawad, 2007, 89(

3 -Unconventional gas, which is divided into:

A- Tight gas, which is found in rock formations.

B - Coal-bed gas Col-Bed Methane.

C - Shale Gas.

D - Gas hydrates, which are gas trapped in ice water layers.

Second: Natural gas processing and its uses

1-Natural gas purification processes are carried out to separate the non-hydrocarbon materials first, then the by-products of economic value are separated from the liquid components for the purpose of obtaining natural gas permanently according to the standard specifications required for that. The pipeline network and gas processing operations are very important in order to protect the infrastructure. The factories that use it and the transmission tubes are free from corrosion and damage, and to ensure that production arrives safely. Recently, gas marketing companies have developed specifications for marketed gas from them (Noring, 2004, 149.)

A- The heat generated by natural gas ranges between (27.8 - 30.7) British thermal units per cubic meter.

b - The moisture of the gas is limited and the gas does not turn into a liquid when pressed in pipes and for long distances.

C- The marketed gas should be free of hydrogen sulfide and carbon dioxide compounds because they help corrode the pipes, as they are required to be free of solid materials.

D - Free from helium and nitrogen gas because it reduces the degree of combustion.

E- Dry water so that aqueous methane compounds are not formed.

H- The mercury should be less than (501) parts per billion parts of gas to avoid equipment damage in processing plants and transport pipelines (Guri, 2012, 19).

**World Economics & Finance Bulletin (WEFB)**
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Vol. 42, January, 2025
**ISSN: 2749-3628,**

The beginning of the treatment processes is by getting rid of water vapor, and from it the gas is pushed to the treatment plants in order to remove the acid gases, because natural gas contains carbon dioxide and hydrogen sulfide at a rate of more than (5.7) mg / cubic meter. The process is called desalination, because acidic gases cause damage Pipes, and ammonia is used for treatment (amine treatment) because it is safer. .
After that, the gas is sent to the drying unit to get rid of water and mercury using activated carbon. The treatment processes are additional costs for the separation of acid gas, but after technological developments, the extracted materials became marketable secondary materials and generate revenues that reduce costs (Abdullah, 1999,11).
When establishing gas processing projects, the reserve operations must be large and commercial, and there must be a market that requires natural gas and its products in order for the economic feasibility to succeed.
2 - uses of natural gas.
As a result of its characteristics, the gas is used in the following areas:
A- It is used as a direct fuel in electric power plants.
b - It is used in the manufacture of iron, steel, aluminum and cement.
C - It is widely used in the petrochemical industry.
d- From gas treatment, incidental materials are extracted, including methane, which is used in compressed natural gas cylinders, which is used in transportation to reduce pollutants. (Judeh, Jaafar, 2014, 43)
Ethane is also extracted from it, which is used to produce ethylene, propane, and butane, which are used for cooling and heating, and natural gasoline, as well as carbon oxides, which are used in some industries of beverages and food protection, as well as in the manufacture of urea.
C - It is used to increase the efficiency of the electricity generation sector through the use of the combined three-cycle turbine, Combined Heat Power Plant (CHP). (Noring, 2004, 147).
3- The costs that are allocated to the production of gas:
A- The investment costs required for research, detection and exploration.
B- The costs of selecting areas for drilling, testing, testing and drilling productive wells.
D- Extraction costs, including buildings, assembly stations, metering equipment, and pipes.
E- Production and processing costs, including processing units and transporting them to consumption areas. (Mohammed, 1985, 54)
F- Marketing costs and includes everything related to the process of marketing the product. It is worth mentioning that natural gas is transferred after the treatment is carried out in two basic ways:
The first method: Through offshore and onshore pipelines.
The second method: transport by tankers, whether ships or private cars (tanks).
(Al-Khattaf, 2007, 44).

## The second topic: the global technology used in the production and industry of natural gas

1 - Trends of development.
The technology used in the natural gas industry has evolved and diversified according to the required use of gas. When natural gas is used in the industrial and domestic sectors, the liquefied petroleum gas technology is adopted. (Liquid Petroleum Gas (LPG)) because the development of this technology took into account the export to the distant global markets to which it is not possible to extend a network of pipelines, and when natural gas is used as a raw material in some industries, the technology of converting gas to hydrocarbon derivatives is developed. , which opened the prospects for many uses of gas in industry on a large scale and the adoption of global markets process and there were trends for changes in the gas industry:
A - Increasing supplies of unconventional natural gas, especially from shale gas in the United States.
B - Increasing the production capacities of liquefied natural gas (LNG), which contributed to the increase in supply.
C - Expanding the use of gas in power plants to reduce pollutants. (IEA, 2014, 3)
2 - Uses of natural gas produced according to technologies.
A- Liquefied Petroleum Gas (LPG).
It is a mixture of butane and propane in varying proportions with some hydrocarbons, but the main component is propane and smaller amounts of butane and lithane, Then the process of separating propane from butane is carried out and it produces an industrial gas used in industry, which is colorless and odorless, and a scented substance is added to identify it upon leakage.
B - Liquefied Natural Gas (LNG).
The methane gas is cooled and the temperature is reduced to (160) degrees Celsius to turn into a liquid, so that the transportation process is easy and takes less volume, and marine tankers are used in the transportation process to keep the gas fields away from places of consumption, and the specialized fleets for this trade and many uses have increased according to the need of importing countries . (Badawi, 2016-4)
v - gas-to-liquids (GTL) conversion.

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

Syntactic Gas is the process of refining natural gas and converting it into marketable liquid hydrocarbon products similar to petroleum derivatives, the production is called Syntactic Gas to produce hydrocarbon fuel free from sulfur and hydrogen pollutants, from which naphtha is produced and emits gas oil, kerosene, paraffin base oils and lubricating oils. It is characterized by the process of converting gases into liquids.

A- By producing clean, high-quality, sulfur-free fuel that burns completely.

B - The use of this method is economically feasible. (Al-Tamimi, 2015, 2).

C - Ease of transportation and the manufacturing process in other areas due to the remoteness of the fields and the difficulty of establishing nearby processing plants.

3- Specifications for gas-to-liquid conversion products.

Table (2)

The most important qualitative specifications for the materials produced and by the GTL method

| diesel | kerosene | naphtha |
|---|---|---|
| Significant reduction in hydrocarbon emissions and uses As a standard fuel for low pollutants | high quality combustion | It is used as a material for crushing units to produce Ethylene because it consists of raw paraffin |
| It is used as an additive to improve the quality and specifications of diesel refineries | high reliability | High yield of ethylene in units cracking |
| Sulfur content close to zero | looks like water | Zero sulfur content |

**Source: The table is from the researcher's work based on:**

**- Al-Shalji, Wissam and Jawad, Muhammad, (Gas-to-liquids technology: its future, its economic returns and its impact on the oil industry) Oil and Arab Cooperation Journal, Volume 33, Issue 121, Kuwait, OAPEC 2007, p. 38.**

It is clear from the table that the qualitative specifications that characterize the GTL technology are to produce diesel, and the amount of polluting substances such as carbon monoxide is reduced, and the sulfur level is close to zero, and with the possibility of adding regular diesel to improve its specifications, while kerosene is of high quality when burning, While naphtha is used to crack ethylene to produce ethylene and the sulfur content is close to zero, there are many uses for the products that emerge from this technology. (Badawi, 2016, 6)

Table (3)

GTL Product Applications

| Products | Uses |
|---|---|
| Normal Paraffin | It is used to produce intermediate materials for the plastics industry and chemical catalysts For the production of transparent agricultural plastics and used as solvents |
| Mixed Paraffin's | It is used in the manufacture of dyes and paints and is used for dry washing materials Hot pesticides and drilling fluids |
| Synthetic paraffin | It is used as oils for industrial, object and automobile purposes, including motor oils Compressors, transmission oils and greases |
| Paraffin wax | It is used to make sweets, printing ink, wire and cosmetics Pharmaceuticals and packaging materials |
| essential oil liquids GTL Base oil | Manufacture of lubricants for various engines |
| GTL Gas oil | It is used as a fuel improver and solvent for the paper and plastic industries To provide a degree of ignition and a material for drilling in the fields |
| GTL Kerosene | As a fuel for ignition and lighting and an additive to paraffin's and aviation fuel. |

**Source: John D .podesta and Timothy E. Wirth ,Natural Gas Bridge Fuel for the 21 Century ,(USA ,center for American Progress ,2009. P103**

It is noted from the table that there are a large number of materials extracted from natural gas using the GTL technology, and the uses vary according to the type of product. For aircraft such as kerosene.

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

It is worth noting that most GTL projects use Fischer-Tropsch technology. The main GTL technologies such as Shell, Sasol, Exxon Mobil and ConocoPhillips technology are technologies for commercial use. There are other technologies developed by Syntroleum and Rentech for associated gas, especially in small fields. . (Abdulali, 2017, 33)

The Fischer-Tropsch technique consists of several stages:

A - Gas manufacturing units.

B - Synthetic gas production units.

It is characterized by high costs, but the products are of high quality, and the feasibility studies for GTL technology projects are affected by crude oil prices, capital and operating costs (Jabbar, 2017, 22).

4 - Effects of the liquefied gas industry on the international gas trade.

A - The effect on supply and demand.

The process of liquefaction of natural gas contributes significantly to the impact on supply and demand for energy sources in general, and on natural gas itself, due to the possibility of transportation from places of production to places of consumption with the availability of supplies and matters related to export and disposal operations with the challenge of distances, and the difficulties that accompany gas pipelines .

With technological progress and the possession of gas specifications and features that encouraged an increase in demand for it and began to compete with other sources. It is expected that the demand for gas is constantly increasing, and perhaps the available supply does not meet the growing demand, which leads to a significant increase in prices, and there are factors that lead to the continued increase in demand for gas and its superiority over Offer including:

1 - Increasing Asian demand by industrialized countries such as China, India, Indonesia, Malaysia, Pakistan and Thailand, which are at the beginning of relying on liquefied natural gas to provide energy, and this demand is expected to increase in the future. (Rajab, 2007, 46)

2 - The high rates of pollution resulting from coal and oil necessitate a shift to clean sources, including gas, especially in some countries that suffer from densely populated countries such as China.

3 - Gas efficiency, high levels of combustion and low waste enhances its future potential.

Thus, these factors will lead to a growing demand with limited supply due to the large investments required, and the demand will be higher than the supply (Horo, 2014, 105)

B - The development of spot and future markets.

Gas contracts were mostly long-term, and after the development of gas trade and the quest of consuming countries to create a competitive market, new ways of dealing appeared, for gas quantities, including the spot and future gas markets. up to (30) days, and the immediate contract may cover short-term contracts extending to a year or less. (Abdul Aali, 2017, 33) The spot market emerged in the United States in the mid-eighties of the last century when the United States sought to lift control over gas prices at the wellhead, and that market constituted an incentive for producers to increase production. As for the future market, which is concerned with the paper side and uses financial derivatives as tools, and therefore has a financial nature These markets emerged as a result of consumers' competition for gas demand, especially in Asia, and the abandonment of nuclear energy due to accidents and radiation, especially Japan, which used Qatari gas to meet its gas needs, as well as India, China and South Korea to increase their dependence on gas, while the European Union has increased demand for gas. Because of the expected decline in Norway's production of gas by 40% in 2025, and the cancellation of the Turkish liquefied gas pipeline due to problems between it and Moscow, and the Balkan countries became in need of gas. (Qatari Ministry of Planning, 2015, 12).

## The third topic: the economics of the natural gas industry in the world

The natural gas market witnessed an increasing demand and its uses expanded, especially in the last decade of the last century, and this resulted through advanced technology that contributed to reducing production and export costs, and using it in the fields of electric power generation and raising its efficiency, in a manner consistent with efforts to reduce environmental pollution, and reduce emissions. Resulting from the uses of fossil fuels, and among the most important reasons that encouraged natural gas trade is the availability of large reserves of gas, which encouraged industrialized countries to direct investments to the gas industry in order to reduce dependence on crude oil as a primary source of energy.

First: the global natural gas reserves.

Technological developments have helped to increase the movement of exploration and thus increase the global reserves of natural gas, through the discovery of new fields as well as the investment of associated gas that is present with oil. (Rulami, 2016, 13)

These developments contributed to reducing the costs of the exploration process and increasing the global reserve rate.

Various methods are used in the exploration process: (Jabbar, 2017, 25)

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

The gravitational and magnetic method, the electric method and the seismic method, which are among the most common methods that are carried out through ground vibrations. Table (4) shows the largest countries with gas reserves, according to the statistics of 2021.

Table (4)
The top ten countries have natural gas reserves / trillion cubic meters

| S | Countries | the reserve | |
|---|---|---|---|
| | | 3013 | 2021 |
| 1 | Russia | 48.7 | 87.805 |
| 2 | Iran | 33.6 | 33.721 |
| 3 | Qatar | 24.7 | 24.072 |
| 4 | United State | 9.86 | 15.484 |
| 5 | Saudi Arabia | 8.60 | 9.200 |
| 6 | Turkmenistan | 17.5 | 7.504 |
| 7 | The UAE | 8.30 | 6.051 |
| 8 | Venezuela | 5.62 | 5.740 |
| 9 | Nigeria | 5.10 | 5.475 |
| 10 | China | 5.21 | 5.440 |

**Source: The table is from the researcher's work based on:**
**OPEC.(2 019).Annual Statistical Bulletin Vienna: OPEC.p23. t 12 .**

It is noted from the table that the countries with the highest reserves are Russia, which has a reserve estimated at (87805) trillion cubic meters and owns giant fields The exploration movement increased and the reserve rose from (48.7) trillion cubic meters in 2013 to (87,805) trillion cubic meters, and it achieved an increase to (49%) during the last ten years. The second place was for Iran, with a reserve estimated at (33.721) trillion cubic meters, and the reserve in 2013 was (33.6) trillion cubic meters, and because of what it suffers from difficult economic conditions, the value of the reserve remained stable.

The third rank in the world was the share of Qatar, which has a reserve estimated at (24.6) trillion cubic meters, and China is the last country in the list of ten countries in the largest reserves, with a reserve estimated at (5440) trillion cubic meters, and we find that there is a large reserve in the world of gas This reserve is subject to increase, as there are many countries that have good reserves worldwide. Iraq ranks 11th globally, as well as Indonesia and Australia, as well as other countries.

Second: the production of natural gas in the world.

As a result of the increase in investments in the natural gas industry and the escalation of demand and the recovery of gas markets, this helped encourage an increase in production in most countries that possess gas reserves, especially after the expansion of exploration areas for onshore and offshore gas fields, and natural gas represents a financial resource in supporting the economies of countries and the following table It shows the production quantities of natural gas for the top ten countries in the world (International Energy Agency, 2014, 5).

Natural gas production for the top ten countries in the world for the period between
2010 - 2 020 / billion cubic meters.

Table (5)
Ten largest gas producing countries in the world

| S | Country | Produce 2010 | Produce 2020 |
|---|---|---|---|
| 1 | United State | 611 | 772.8 |
| 2 | Russia | 588.9 | 665.4 |
| 3 | Canada | 138.5 | 159.1 |
| 4 | Iran | 116.7 | 214.5 |
| 5 | Qatar | 106.7 | 166.4 |
| 6 | Norway | 96.8 | 123.9 |
| 7 | China | 83.9 | 145.9 |
| 8 | Saudi Arabia | 83 | 109.3 |
| 9 | Indonesia | 80.4 | 72.09 |
| 10 | Algeria | 1128.9 | 116.9 |
| 11 | rest of countries | 3193.3 | 4215.9 |

**Source: The table is from the researcher's work based on:**

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

**OPEC.(2019).Annual Statistical Bulletin Vienna: OPEC.p33. t 14 .**

It is noted from the above table that countries' production of natural gas increased in general in all countries for the period between 2010-2020 and the United States of America was in the first place in production globally, as its production reached (772.8) billion cubic meters per year after it was (611) billion cubic meters in 2010, and Russia comes in second place in global production, as its production reached (665.4) billion cubic meters in 2020 after it was (588.9) billion cubic meters in 2010, while Canada ranked third in the world, producing (138.5) In 2010, its production increased to (159.1) billion cubic meters / year Algeria was the tenth country in gas production, and its production reached (116.9) billion cubic meters in 2020, and this gives an impression of the importance of natural gas and the increase in production in most countries during the last ten years. (Roulami, 2016, 14)

Third: the global consumption of natural gas.

As a result of the characteristics of natural gas and its high efficiency, it made it an important source of energy, and there are a number of factors that helped increase consumption of natural gas

A- An increase in the growth rates of the global economy.

B - Increased attention to the environment and the problems associated with pollution resulting from the combustion of oil and coal.

C - high oil prices.

d- The world's endeavor to improve and diversify energy sources and preserve them.

E- Reducing dependence on nuclear energy and its environmental risks. (Badawi, 2016, 7) Companies specialized in the production of energy tended to establish plants that run on natural gas instead of nuclear plants, due to the impact of this due to waste and radiation.

And it makes up (20%) in the European Union, in addition to the uses that have also increased, such as domestic and industrial use. Table No. (6) shows the consumption of the largest ten countries of natural gas

Table No. (6)
Countries' consumption of natural gas, cubic meter/year

| S | Country | Consumption2005 | Consumption2010 | growth rate |
|---|---|---|---|---|
| 1 | United State | 623.3 | 683.4 | 1 |
| 2 | Russia | 400.5 | 372.7 | 3 |
| 3 | Iran | 105 | 136.9 | 9 |
| 4 | China | 46.8 | 109 | 20 |
| 5 | Japan | 78.6 | 94.5 | 2 |
| 6 | Canada | 27.8 | 93.8 | 3 |
| 7 | Britain | 90.1 | 93.8 | 3 |
| 8 | Saudi Arabia | 71.2 | 83.9 | 6 |
| 9 | Germany | 86.2 | 81.3 | 1 |
| 10 | Italy | 79.1 | 76.1 | 2 |
| 11 | Countries of the world | 11462 | 1343.6 | 5 |

**Source: The table is from the researcher's work based on**:

**OPEC.(1019).Annual Statistical Bulletin Vienna: OPEC.P22.t 9**

It is noted from the table that the United States is the country that consumes the most natural gas according to 2010 data, with consumption of (683.4) billion cubic meters / year, followed by Russia with consumption (372.7) billion cubic meters / year

Then Iran ranked third in the world as it consumes (136.9) billion cubic meters / year, and Italy, which is eleven countries in gas consumption, as it consumes (76.1) billion cubic meters / year, and the total world consumption is about (3169) billion cubic meters / year, and when Comparing the consumption of 2005, it is noted that in most countries consuming natural gas, the percentages increased at different growth rates, and this gives an indication of the increase in consumption, through the increase in multiple uses. In general, we can say that gas consumption is constantly increasing, and North America is one of the largest regions consuming natural gas, then South America, as these regions alone consume up to 27.6% of their production, respectively, and Europe comes in third place, as it consumes (34.3%) of its production. As for the Middle East, it consumes (46.9%) of its consumption, while Asia consumes (11.1) percent of its production. (Horo,2014,107)

Fourth: The consumption of natural gas compared to other types of energy sources

The process of reliance on energy sources changes globally over time according to the course of markets, technology, prices, demand and other factors affecting energy sources, and even sometimes political aspects and

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Vol. 42, January, 2025
**ISSN: 2749-3628,**

international conflicts enter the line of influence by moving towards multiple alternatives to energy, and the problems the world faces regarding environmental pollution And global warming resulting from pollutants emissions from the use of fossil fuels, and it should be noted that the multiple energy sources are fossil fuels represented by oil, coal and natural gas, then nuclear energy, as well as renewable energy represented by wind, water, geothermal and solar energy, but they did not rise to fossil energy sources because of the high Multiple costs and factors delay its development

Table No. (7)
Comparison of energy sources in terms of consumption
for the period 2010-2020

| Years | Oil | Coal | Gas Nuclear | Energy | Renewable Energy |
|---|---|---|---|---|---|
| 2010 | 38.8 | 29 | 24.7 | 6.7 | 0.5 |
| 2011 | 37.4 | 29.7 | 24.6 | 6.8 | 0.6 |
| 2012 | 36.9 | 30.5 | 24.6 | 6.7 | 0.6 |
| 2013 | 35.9 | 30.9 | 25.3 | 6.4 | 0.7 |
| 2014 | 35.5 | 31 | 25.4 | 6.4 | 0.8 |
| 2015 | 35.1 | 31.1 | 25.6 | 6.2 | 0.8 |
| 2016 | 34.8 | 31.7 | 25.8 | 6.1 | 0.9 |
| 2017 | 34.6 | 31.9 | 26.1 | 5.9 | 1.1 |
| 2018 | 34.3 | 32.1 | 26.5 | 5.7 | 1.2 |
| 2019 | 33.9 | 32.5 | 26.7 | 5.8 | 1.4 |
| 2020 | 33.6 | 33.2 | 26.9 | 5.6 | 1.8 |

**Source: The table is from the researcher's work, with accreditation:**
**OPEC.(2019).Annual Statistical Bulletin Vienna: OPEC.P.25.**

It is noted from the table that oil is the source of energy consumed globally, followed by coal, then gas, then nuclear energy, and then renewable energy sources.

And the use of oil is gradually declining against the rise of natural gas, and it is expected that gas will lead the energy sources in the future because of the advantages it enjoys, as the use of gas rose from (24.7%) of global consumption to (26.9%), in contrast, oil declined from ( 38.8%) to (33.6%), as well as coal, its use increased from (29%) to (33.2%), while nuclear energy increased from (6.7%) to (5.6%), or renewable energy increased from (0.5%) to ( 1.8%) during the last decade of this century.

but renewable energy sources are developing little and at simple rates, due to the high costs and that factories, factories, means of transportation and even existing power stations are designed in a way that suits the use of a specific type of fuel, and the process of change takes a long time. (Al-Tamimi, 2015,6)

Fifth: Global natural gas trade

1- Exports and imports of natural gas

The natural gas trade occupied an important place in the energy markets, after the global demand for it increased, the exploration increased and the costs decreased in proportion, as well as the advantages possessed by gas, and after the technological developments that developed the joints of that industry, after the transportation process was traditionally done by pipelines After discovering the process and liquefaction and finding the possibility of transportation to distant markets, it contributed greatly to the popularity of natural gas trade, and the following table shows the volume of exports of natural gas.

Table (8)
Exports of the largest ten countries of natural gas for the period 2010-2020
billion cubic meters / year

| S | Country | Exports 2010 | Exports 2020 | World Total |
|---|---|---|---|---|
| 1 | Russia | 223.3 | 197 | 22.4 |
| 2 | Qatar | 107 | 123 | 10.7 |
| 3 | Norway | 99.7 | 112 | 10 |
| 4 | Canada | 92.2 | 78 | 9.2 |
| 5 | Algeria | 57.3 | 43 | 5.7 |
| 6 | Holland | 53.3 | 53 | 4.2 |
| 7 | Malaysia | 31.9 | 43 | 3.2 |
| 8 | Australia | 25.4 | 34 | 2.5 |

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

| | | | | |
|---|---|---|---|---|
| 9 | United State | 54 | 50 | 7.3 |
| 10 | Turkmenistan | 41.3 | 40 | 4 .7 |

**Source: Table prepared by the researcher based on:**
**OPEC.(2019).Annual Statistical Bulletin Vienna: OPEC .P18.**

It is noted from the table that gas exports in 2010 to the top ten countries were higher than in 2020, for several reasons, including the development of the gas industry in the same countries, and the industry and generation consumed in larger quantities, so exports declined and in addition to this the exceptional circumstance that the world is experiencing in light of the Corona pandemic And its negative effects on the global economy, so exports declined due to the decline in demand for all energy sources, not just natural gas. Russia is the first country in gas exports, as it exports (22.4%) of the world's exports, followed by Qatar, which acquires (10%) of Global gas exports, then Norway. In terms of imports, at the forefront of gas importing countries is China, as its imports constitute (10.8%) of the volume of import in the world, followed by Japan, which imports (93.4%) billion cubic meters / year in the form of LNG Its imports constitute (9.6%) of the world's imports, followed by Germany, which imports (92.8%) billion cubic meters annually, at a rate of (9.5%), according to 2010 statistics, and due to the decline in winter temperatures, the rates of gas use in heating operations increased.

2 - Global natural gas markets

Natural gas markets in the world were characterized by being limited, but after technological developments and the increase in the possibilities of transportation and export to further places and in advanced ways, after it depended only on extending pipelines from the places of production to the places of final consumption, this led to an increase in the interconnection between the natural gas markets.

It is noted that the natural gas trade is fraught with great risks, in addition to high costs, and these matters are among the challenges facing the natural gas markets and trade because they differ from other types of fuels, as they require special technologies and special transport messages, which require exceptional and large costs, and are characterized by a long payback period. This led to the weakness and delay of the gas markets, and there are no markets at the same level as the international oil markets. The degrees of development in the gas markets vary according to the quantities exported and imported and the pricing methods, and these markets witnessed an openness to producers in all countries of the world and holding continuous meetings to find a conglomerate and gathering of natural gas producers aimed at To reduce costs, reduce government intervention and allow private companies to enter the natural gas investment market through the following (Abdul Aali, 2017, 34)

A- Allow private companies to use government and private pipeline networks for transmission and distribution, and LNG facilities for collection, storage and processing.

b- Controlling prices, giving facilities, and reducing taxes and wage costs for using public facilities.

C - fragmentation of the gas industry into stages and episodes such as the stage of exploration and production, internal and external transport and distribution to prevent monopoly because most gas supply contracts depend on long-term contracts.

Either the most important markets in the world specialized in natural gas are:

A - The American market.

The energy sector in the United States of America depends on the consumption of natural gas at a rate of up to (27.6%) of the total need. Therefore, the American market for natural gas has become very competitive because natural gas companies seek to expand in order to meet the increasing demand, because the American stockpile only meets the need. For one season only, in order to increase demand in the winter season and there is a significant impact of temperatures in the winter season. If it is freezing and very cold, prices rise to a level of more than (10%).

There are two types of contracts for natural gas in the American market, the first are short-term contracts, which are determined by three factors (weather, stock size, and the rate of economic growth), and the second type are long-term contracts, which are determined by the global economic situation, quantities of demand and supply, and oil and coal prices. Pricing of natural gas in the US market according to the pricing of Henry Hope Center in the US state of Louisiana. (Geller, 2009, 19)

B - the European market.

The European market depends on supplying it with natural gas from Russia as the main supplier, and in many cases the market is affected by gas imports from Russia via Ukraine due to political problems There are plans to secure the arrival of gas and diversify the sources of supply to the European market through additional pipelines to supply gas, from the Republic of Egypt and Algeria through Tunisia and Morocco. As a source of electric power generation, and in the European market, pricing is applied linked to oil derivatives. Norway is an important link in the gas-producing countries, and its production increased from (49.7%) billion cubic meters in 2000 to (06.4%) billion cubic meters in

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

2010 with a growth rate of (7%) ), which ranks fifth in the world in terms of production, and the European Union is seeking to diversify gas sources by heading to Africa in the Middle East.

C - the Asian market.

Some Asian countries are among the most prominent consumers of natural gas, including Japan, South Korea, Taiwan and China, which is the fourth consumer in the world. Imports of liquefied natural gas (LNG) are relied upon to meet the needs of those countries, while export is based on the pipeline network, especially the line in Malaysia and Singapore.

A mixture of energy sources is used in the Asian market and according to sectors, such as the industrial and domestic sectors, and there is a move for the State of Qatar to unite efforts for gas producers and organize the Asian market. (Abdulali, 2017, 36) Sixth: Natural gas pricing

There is a difference in gas prices in international markets from one market to another due to the different pricing mechanisms, and some considerations related to the type of gas imported by pipelines or liquefied, and the consumer's distance from the production markets and its calorific value.

Gas pricing is determined on the thermal level that results from combustion, expressed in British thermal unit BTU, and the market is calculated in US dollars per million British thermal units (MMBTU), and gas is exported on the basis of the CIF system in most cases, and in some contracts the (CIF) system is used. FOB), and that the prices of liquefied natural gas (LNG) are higher than the prices of gas exported through pipelines, due to the costs of the process of purification, liquefaction and return again in the country of consumption, and gas prices include the following costs. (Jabbar, 2017, 24)

A- Total costs (capital and operational) for all stages of production, processing, transportation and liquefaction costs.

B - the economic return (profit).

C- The depletion premium, which is part of the price to compensate for the depletion of the resource

D- Environmental fees

The method adopted for pricing is affected by many factors, including the type of end use, target market and export methods

There are several ways to price gas, which are as follows:

1 - Cost recovery pricing, which includes all production costs and taxes until it arrives according to the CIF delivery system (Guri, 2012, 19).

2- Competitive Netback pricing.

The first price paid for gas is determined by the price of the cheapest alternative fuel available to the consumer, and on the basis of competition

Energy alternatives, and the price is adjusted after accounting for additional factors such as taxes, the difference in efficiency of use and environmental costs.

Natural gas in general is priced in the form of a price formula, especially in long-term contracts due to the presence of high flexibility, and the price depends on the basis of negotiations and according to the strength of the negotiating position and the quality of the exported natural gas

(Free or associated) and the percentage of natural gas consumption between traditional and renewable energy sources in the importing country. The price of natural gas is affected by the impact of the prices of oil derivatives, significantly. (Noring, 2004, 150)

Seventh: The effects of gas industry developments on global oil markets.

There are great challenges facing humanity in the matter of energy sources, especially with regard to the future, from the side of a continuous increase and growth in demand for energy and its sources, and on the other hand there are theories of the natural depletion of oil and the decline of its role as a result of environmental changes that pressured towards change to alternative sources of oil, for the causes of the resulting pollution The burning of oil, the increase in heat emissions and the turbulent rise in temperatures, which prompted many countries to develop and diversify energy sources and seek to shift towards cleaner and less polluted energy, as well as the political reasons involved in limiting the oil-producing countries to influence energy prices and restrict large consumers They represent the major industrial countries.

Therefore, natural gas has become the most in demand, and expectations indicate that energy consumption will double in 2030, and will triple in 2050 compared to energy consumption in 1990, and by tracking the reality, the demand for gas increased from (3562.7) million tons of oil equivalent in In 2020, it will reach (4497.4) million tons equivalent, and it is expected to reach in 2035 until it reaches (5693.1) million tons equivalent in 2040, through studies and forecasts of OPEC and according to the approved reference status, as shown in the following table:

Table (9)

OPEC Oil and Gas Outlook Reference Scenario (million tons of oil equivalent/year)

| | Global supplies of oil and gas | growth rate |
|---|---|---|

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

| source / year | 2020 | 2035 | 2040 | |
|---|---|---|---|---|
| oil | 4558.5 | 4897.4 | 5113.0 | 0.7 |
| gas | 3562.7 | 4494.0 | 5693.1 | 2.4 |

**Source: OPEC ,world oil outlook ,2014 .p8.**

It is clear from the table that the rate of oil supplies is increasing at a rate of (0.7), but gas is increasing at a much higher rate (2.4%). At the level of world regions, Asia's consumption of natural gas is expected to rise to surpass North America, with Asia becoming the largest consumer of gas. Europe's demand for gas is expected to increase due to the depletion of its fields, and as a result of the increase in petrochemical industries, the Middle East will be a major consumer of natural gas.

As well as domestic use and electricity and after Japan abandoned nuclear energy after the leakage accidents in Fukushima, as well as other countries are planning to move away from nuclear energy because of the risks and residues resulting from it and the difficulty of disposal.

On the other hand, the global oil market faces many variables, economic factors, the environment, and competition for other sources of energy, so it requires a quantitative and qualitative analysis of the oil and gas market. From a quantitative point of view, it is necessary to know the volume of supplies that the gas market can compete with the global oil market, either qualitatively, and trade patterns refer to The rise in oil prices and the decline in gas prices due to the decline in costs, so gas enters a competition, as happened in the seventies and eighties of the twentieth century when oil prices rose. Part of the demand was directed to cheap coal and nuclear energy, and gas is characterized by the presence of large proven and discovered reserves, which makes it a competitor in the energy market Especially for crude oil, an increase in oil prices will face great competition for gas, so oil needs competitive prices. (Qatari Ministry of Planning, 12, 2015)

There are practical and serious steps to use gas in the transportation and communications sector, which is one of the most important sectors consuming oil. It is certain that in the future, oil will surrender to natural gas, especially with technological developments that seek to reduce costs and increase future profit rates, so natural gas is a greater competitor and challenger, which affects in a way It has a significant impact on oil markets and future contracts, and even affects the directions and plans of companies operating in the energy sector.

## CONCLUSIONS AND RECOMMENDATIONS

### First- the conclusions

1- Through the course of the research, the researcher reached to prove the research hypothesis, which is that the natural gas industry greatly affects the global oil markets, due to the gas's thermal efficiency, low pollution and waste resulting from use, and thus it can be an alternative to oil, and it competes for the lead In the list of energy sources, if oil prices rise significantly.

2- There is a tendency for many oil consumers to increase the use of natural gas in industry, in generation stations and domestic use, and the most difficult obstacle is production costs, and with the continuous technological development, it can contribute to reducing costs and directing global demand for natural gas, and taking over the points market.

3- Natural gas is a good fuel through its low impact on environmental pollution compared to other fossil fuels such as coal and oil, so its industry is witnessing rapid development and wide interest with the increase in proven reserves, the increasing demand for energy sources and the endeavor of some consuming countries to reduce dependence on oil, and prevent monopoly Energy sources from the producing countries according to their point of view.

4-The gas industry faces challenges and difficulties represented in the difficulty of transportation and the risks associated with it, its high cost, the need for safety equipment and special transportation fleets with high safety conditions, and the decline in investments due to the long period of capital. recover.

5- In the short term, oil will remain a strong competitor as a fuel because various industries, infrastructure, factories and other facilities were designed to use petroleum fuels, and the process of change requires a long period of time to use gas at a broader level.

6- With the development of the natural gas industry and the use of modern technologies, a part of the total oil demand will be directed towards gas demand, and the use will shift to gas in important sectors, especially in the transportation sector, which is the largest. An oil consumer, as car manufacturers try to increase production of cars that use gas instead of gasoline, this will lead to a downturn in global oil

### Second- recommendations

1- Establishing an international grouping of natural gas producers and consumers to set strategic plans for cooperation and development in the field of the natural gas industry and to seek to reduce costs and use the results of scientific research to reduce risks and secure natural gas supply lines to serve human societies.

2- Providing facilities and support for private sector companies to enter the natural gas investment market by reducing taxes, granting loans and allowing the use of pipelines and government infrastructure.

**World Economics & Finance Bulletin (WEFB)**
**Available Online at:** https://www.scholarexpress.net
Vol. 42, January, 2025
**ISSN: 2749-3628,**

3- Finding a kind of high international coordination, through the formation of specialized research teams in order to formulate economic policies that help meet the increasing demand for energy sources, and in a manner that guarantees the rights of producers and consumers.

4 - The producing countries establish investment funds to benefit from oil revenues to establish future investment projects to guarantee the rights of future generations, in the event that the oil market declines significantly because it is a depleted substance.

5- The international community should take into account the effects of environmental pollution, and increase the interest in the issue of global warming and reduce the damage caused to the environment, and put it at the center of attention, in order to find real solutions at the level of fossil fuel-producing and consuming countries.

6- Develop the oil industry in a way that contributes to reducing emissions and pollutants, lowering prices appropriately, and preventing monopoly on oil markets in particular and energy markets in general, because they are linked to the growth rates of the global economy and thus increase the welfare of peoples.

7- Reducing political tensions, preventing the outbreak of conflict and conflict in order to acquire energy sources, and solving outstanding problems through dialogue and negotiation in a way that guarantees the rights of all parties.

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