

Unconventional Gases Between the Environmental and Energy Crises

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Abstract: The sudden advancement in the technology of unconventional gas production, especially in the United States, has aroused the interest of those interested in energy affairs, as this technical progress allowed greater economic contact with the supply of conventional natural gas, especially with the achievement of large-scale production of unconventional gas pools. In spite of what the technological developments of that industry promise to advance its place in unconventional gas, and the economic effects that it can have, especially with the development of discoveries of its resources over time, on both energy producers and importers. However, opinions were divided between opponents and supporters of its exploitation, whether due to its economic effects. Especially since its exploitation will give many countries the opportunity to give up or reduce dependence on natural gas, especially the United States of America, China and the countries of the European Union; The matter will also negatively affect the countries producing natural gas due to the economic impacts resulting from the expansion of production of that alternative. Or because of its environmental impacts resulting from its use as a fossil fuel, or the technology used in its extraction and production and its harmful effects on water resources and land. This issue will be addressed by seeking to determine the effects resulting from the expansion of unconventional gas production, and whether the exploitation of unconventional gas gives satisfactory economic results that justify the cost that will be borne by society, and the question and what effects this type of energy can have. Through a research plan consisting of an introductory topic entitled What are non-conventional gases, the first topic titled Motives for Expansion in the Production of Non-Conventional Gases, the Second Study entitled the Importance of Non-Conventional Gases and the Controversy Around them, the Third Study entitled "Non-conventional Gas Production and the Strategy of Advanced Countries for Energy Security, Conclusion, Conclusions and recommendations.

Keywords: Unconventional Gases, Conventional Gases, Shale Gas, The Environmental Problem, Climate Change, The Energy Crisis

1. Introduction

The efforts of developed countries to search for alternative and unconventional sources of fossil fuels have increased. The revolution in the unconventional gas industry as an unconventional source of energy aroused the interest of these countries, and opinions were divided between those who oppose and support its exploitation. Especially since its exploitation will give many countries the opportunity to give up or reduce dependence on natural gas, especially the United States of America, China and the countries of the European Union; The matter will also

negatively affect the countries producing natural gas, due to the economic impacts resulting from the expansion of production of that alternative.

The technological developments of that industry also promise the upgrading of unconventional gas, and the economic impacts that it can have, especially with the development of discoveries of its resources over time, on both energy producers and importers.

Despite these positive advantages, which make unconventional gas one of the promising solutions to the energy crisis and one of the solutions to the problem of European countries' subjugation to Russia as the monopoly

of the supply of natural gas to it, there are negative economic and environmental impacts resulting from the method of producing this type of fuel; Including the escalation of conflict over water resources due to the increasing need for water, whether to be used in the production of this gas or in the emissions resulting from the production process itself, in addition to the increase in soil erosion rates and the high levels of pollution.

2. About Unconventional Gases

Unconventional gas has a special nature, as it has the potential to provide opportunities in the field of energy and its uses. So what is unconventional gas? What is its inception and the beginning of reliance on it as an alternative to natural gas, and to whom is the credit for the success of relying on natural gas?

2.1. What Are Unconventional Gases

2.1.1. Concept

Unconventional gases are gases that do not differ from conventional gases in terms of their composition, but they are produced by manufacturing technology, where these gases are located at a depth of 2000-5000 meters. Whereas, the greater the depth of natural gas deposits, the more advanced technology and techniques needed to extract it, and in return, the volume of gas expected to be extracted increases. [1]

2.1.2. Exploitable Species

Unconventional gas is divided into several types, including three main types and it is the only one that is practically formed on the industrial scale at the present time, and another type there are technical and environmental difficulties facing the possibility of exploiting it in the near term. [2]

Shale gas: is natural gas that is produced from reservoirs predominantly composed of shale (a fine-grained sedimentary rock which is easily breakable into thin, parallel layers), rather than from more conventional sandstone or limestone reservoirs.

Coal gas: this type of gas is usually located at a depth between 800-1200 meters; It is related to shale gas, except that it is present in the same coal layers. [3]

2.2. Emergence and Development of Production

The first commercial shale gas well was drilled in New York, USA, 1821, before the first oil well was drilled, and it produced limited quantities of gas from shallow shale fractured formations. [4]

2.2.1. The Use of Shale Gas Commercially

Thanks to George Mitchell, he was able to develop the hydraulic fragmentation technique, which is the process of pumping water and chemicals into deep wells, in a way that allows the flow of natural gas trapped in the rocks. [5]

2.2.2. The Development of Shale Gas Production in the United States

The United States produces shale gas thanks to horizontal drilling techniques and innovative processing techniques, and it has come to cover a large part of domestic consumption, as the volume of production in the United States was estimated at 0.3 trillion cubic feet, which represented about 1.6% of the total American production of gas in 1996, and increased in 2000 To 0.39 trillion cubic feet. By the year 2006, production had tripled, reaching 1.1 trillion cubic feet, which constituted about 5.9% of the total gas production in the United States, and the largest jump in production occurred during the years 2007-2012.

After less than a decade, the average total US production of shale gas increased significantly, during the third quarter of 2019 by about 9.2 billion cubic meters, or 4.5% compared to the levels of the second quarter of 2019, to reach 213.6 billion cubic meters, up by 28.4 billion Cubic meters, or 15.3%, compared to the same quarter of 2018. [6]

3. The Motives for Expanding the Production of Unconventional Gases

3.1. The Need for Unconventional Energy Sources

The fluctuations in fossil fuel prices and exposures to depletion are an obstacle to the goals of countries in terms of sustainable energy sources to achieve development. Which was a reason for the trend towards unconventional gases as one of the solutions to the energy problem and control of the natural gas markets in particular.

3.1.1. The Priority of Gas as a Source of Energy in the Future

Those interested in the field of energy see that it is appropriate for gas to be a priority in energy insurance policies, due to its environmental distinction because it causes less emissions compared to other types of fossil fuels, which reduces concerns about air quality. Despite facing stiff competition from coal, as well as renewable energies, which will become a less expensive source of gas to generate electricity in some countries by the mid-twenties of the current century. [7]

3.1.2. The Impact on Natural Gas Prices

The volume of shale gas production affects the natural gas prices as follows.

Achieving the expected levels of unconventional gas production will compensate for the decline in conventional gas resources.

Technological progress may allow the use of large quantities of shale gas that were not feasible before, this raises expectations for an increase in the volume of production and supply of gas. As the production of shale gas increased twenty times during the period from 2000-2011 and it is expected that it will reach half of its natural gas production in 2035.

The volume of production of unconventional gases at the time of the 2008 crisis kept gas prices at low levels. In the context of the relative fluctuations in gas prices, we find (in the United States) 80% less in 2013 compared to 2005, but this effect remains limited outside the United States.

The fragmentation of the regional gas market and its difference is due to the difference in the distribution of unconventional resources that can be exploited on the one hand, to differences in price formation at the regional level, regulatory factors, and the high cost of the infrastructure. [8]

3.2. Transformations in the Natural Gas Market

Gas markets will witness in the coming years an accumulation up to the point of abundance, due to the emergence of large quantities of natural gas [9], and taking into account the expected future development of shale gas production, it will be difficult to predict what the demand for natural gas will look like in the future, and what are the centers of gravity. [10]

4. The Importance of Unconventional Gases and the Controversy Around Them

Unconventional energy resources, including shale gas, play a future role in the energy field-but what weakens their exploitation in many places where their resources are available is that they do not enjoy the required social acceptance, for environmental reasons. Although shale gas is topped as one of the potential solutions to the challenges related to the energy sector, due to its resources and the role of emerging technologies, which increases the rate of current reserves estimates. [11]

4.1. Unconventional Gases from a Sustainable Development Perspective

In September 2015, the United Nations adopted new goals for sustainable development, including ensuring that everyone has access to affordable, reliable and modern energy services [12] taking into account the environmental aspect and facing global warming. [13] And reaching a safe amount of carbon. [14] Access to it requires that 80% of coal, 50% of gas, and less than a third of the oil remain in the ground without combustion. [15] Otherwise, the problem will worsen with the continuation of the current level of emissions. [16]

Therefore, from a purely sustainable development perspective, the development of unconventional gas sources is useless. Therefore, the European Union countries have taken the side that is not supportive of expanding the production of unconventional gases in order to fulfill their obligations related to climate change. This is according to the 2016 Council of Europe document on the exploration and exploitation of unconventional gases [17], which makes the responsibility for environmental obligations on the member

states of the Council of Europe, which means that the exploration and exploitation of unconventional fuels should be reduced in favor of research and development to cleaner alternatives. Despite this, the momentum needed to develop its resources in Europe should not be underestimated, as shale gas production is often argued as an important way to diversify energy supplies and reduce imports. [18]

4.2. Opinions for and Against Conventional Gas Production and Their Justifications

Expansion in the production of unconventional gases is represented by two opposing directions. The first calls for support for expansion, and is opposed by another trend that rejects that expansion due to the negative effects this expansion carries.

4.2.1. The Trend in Support of Expansion and Positive Impacts

The trend in support of expansion depends on the accelerated nature of the consumption of conventional gas reserves, due to the development of its areas of exploitation, and that adding unconventional gas resources to the remaining reserves of natural gas will make gas prices more competitive with other energy sources.

1. A tool to counter the impact of political fluctuations on energy supplies

Shale gas production helped in the United States helped oil producers respond to the gas production boom, which was the first time that oil prices did not increase despite the severe instability in the region. [19]

2. The obsession with peak gas is gone

Because of the ability of unconventional gases to absorb the increasing global demand for natural gas due to the increase in its use in generating electricity as a clean fuel in addition to its low cost. With the possibility of the world production of shale gas and other conventional gases three times during the period 2011-2030. [20]

3. Increasing optimism about shale gas resources and the possibility of exploiting them

Recent studies estimate the resource stock of five of the largest shale gas basins in the United States at about 3760 trillion cubic feet, of which 475 trillion cubic feet are economically recoverable, and it is estimated that two basins in Canada contain about 1380 trillion cubic feet, 240 trillion cubic feet of which are recoverable. [21]

4. The effect of unconventional gas production on natural gas prices

The United States became a candidate to be an exporter of LNG due to its shale gas boom, along with an increase in natural gas production by about 20% between 2008 and 2012, and the International Energy Agency expects that the production of shale gas will increase by 630 billion cubic meters, which will make it achieve a number Record in its output. It will have wide impacts in North America, by encouraging large investments in petrochemicals and other energy-intensive industries. [22]

5. Decline in crowding out

This shift is also important for European and Asian gas importers who seek to benefit from the oversupply as new gas reserves are found over time around the world. This cultivates optimism about the future of fuel.

6. Gas technologies can play a major role in the low-carbon transition.

As countries and regions pursue a low-carbon transition, technologies such as biomethane, hydrogen and gas with carbon capture could play an important role, serving to decarbonize sectors of the economy that are currently seen as 'hard to abate', and providing opportunities for long-term growth for the gas industry. However, investment and policy support are needed to scale up these solutions. [23]

4.2.2. Tendency to Reject Expansion and Negative Influences

On the other hand, there was a trend rejecting the expansion of the exploitation of unconventional gases represented by many European countries. Countries such as Germany and France refrained from producing unconventional gas under the pressure of environmental organizations and their citizens' refusal to invest in this type of energy source.

4.2.3. Justifications for the Trend Rejecting Expansion

1. The economic aspect

a. The specificity of each country's status regarding the possibility of exploitation.

Many studies have shown that the base of shale gas resources is large and widespread at the same time, and yet the quantities have not yet been determined at the national level in most countries. In addition, some countries face obstacles that differ from those in other countries. The Asian continent has technical problems such as the depth of oil shale deposits, its proximity to urban areas and the lack of technical skills that make the exploitation costly. [24] And some European countries such as Hungary and Poland are difficult to produce shale gas profitably, and others such as Bulgaria, Germany and France are already opposed to gas extraction. Rocks due to environmental reasons. [25]

b. The shale gas revolution is limited to the United States

The development of hydraulic fracturing techniques contributed to reducing the cost of producing shale gas, which made production in the United States commercially viable, and eliminated the US need to import liquefied natural gas. However, this decline in gas demand in the United States was compensated for by the strong demand that came from Asia, especially from Japan, after the Fukushima reactor accident.

c. The high cost

The problem of the high cost of the extraction and exploitation of unconventional gases is the most important obstacle facing this source of energy sources, as there is a variation in estimating the cost of producing unconventional gases not only between countries but also within the country itself. [26]

d. Information discrepancy

More information on technically recoverable shale gas

resources, for example, according to the 2011 United States Energy Information Administration report, that Poland has 187 trillion cubic feet of technically recoverable shale gas resources. [27] But the Polish Geological Institute study for 2012 showed that the aforementioned report was overly optimistic because the shale gas resources in Poland do not exceed 768 billion cubic meters. [28]

Water consumption and unconventional gases production

Water consumption is one of the obstacles to investment in the production of unconventional gases, especially in Asia, as it represents a real challenge for most countries of Asia and the Pacific, as the region owns 32% of the global freshwater resources and is inhabited by about 58% of the world's population. [29]

2-The environmental aspect

a. Production technology

The technique of producing unconventional gases is based on hydraulic fracturing, which is a method of utilizing the underground gas by injecting high-pressure water and chemicals to break the rocks and release the trapped gas, and this technique raises a number of health and environmental problems. [30]

b. Impact on water resources

Hydraulic fracturing pollutes surface and ground water sources with methane, chemicals, and waste, and is usually disposed of in the cheapest way to reduce production costs, regardless of the environmental consequences. Besides, the use of fracturing technology requires water to create fluids (frac), which is considered a severe pollutant. Because of the environment due to heavy metals and radioactive elements, and with a large part of it returning to the surface, and without proper monitoring, liquids can be thrown into rivers and streams, which contaminates them. [31] Besides, gas migration and underground scrubbing means may pollute the groundwater due to fracturing itself. [32] This is in addition to other methods of leakage. [33]

A single well consumes between 24.5-36.6 thousand cubic meters of water by fracturing technology. Given the volume of water needed by one well, it consumes the equivalent of the per capita consumption of developing countries over a period of 35 to 52 years, and at least a third of this amount cannot be recovered. [34]

c. Impact on climate

Many studies indicate that shale gas is just as harmful as coal in terms of climate change. [35] If gas is burned instead of coal, emissions will exceed 2% of gas production. [36] Shale gas combustion is twice as bad as coal, so combustion of more unconventional gases will increase fossil fuel pollution, lead to increased emissions and make mitigation intensified. Climate change is more difficult.

d. Impact on land use and biodiversity

Unconventional gas extraction can alter the dynamics of the Earth's substrate. The technical development of extraction methods led to the innovation of horizontal drilling, and the spread of the fracturing process, increasing the likelihood of earthquakes. [37]

Also, deforestation to use them as fracking sites leads to

contamination of the land with acid rain, due to water leaks contaminated with chemicals that seep into storms that spread chemicals into the environment, and the harmful effects of fracking extend to wild animals in terms of (habitat loss, obstacles to the migration of species. Endangered species, and deaths from drinking and breathing polluted water and air). [38]

e. Impact on health

There are 353 chemicals used in cracking that have been identified, many of which can cause cancer and other serious health problems.

A Harvard University study documented a 30% increase in methane emissions in the United States since 2002, ranging from 30 to 30%. 60% of the increase in atmospheric methane is global during the same period. [39]

Some studies also show that polluting particles that cracking technology spreads in the air may have effects on pregnant women and children and expose them to low IQ, in addition to contamination of water supplies by the chemicals used in fracking. [40] The New York State Environmental Impact Assessment (EIA) has performed. To the ban on fracking in New York State. [41]

3. The legal aspect

a. Proof of pollution status

The burden of proving pollution falls on the population and not on the industry, which prevents the existence of a penalty against polluters, and there is no standard for imposing fines based on violations that are discovered periodically or based on violations listed in regulations that define the standard and form of violations, as fines in cases of accidental pollution are not sufficient to deter Violators, and regulations often do not apply the fine. [42] The US Environmental Protection Agency is not mandated to routinely monitor shale gas extraction.

b. Environmental exemptions

The United States granted the extraction industry exemptions from the most important environmental regulations, and therefore the US Environmental Protection Agency was not authorized to carry out routine monitoring operations for unconventional gas extraction. In addition to what those in charge of the gas industry do to prevent individuals from submitting complaints by means of financial inducements or non-disclosure requirements to avoid potential environmental and health issues resulting from fracking.

4.3. European Opposition

Numerous reports and directives have been issued regarding the implications of unconventional gas extraction techniques on environmental resources and means of reducing their damages. [43] However, the mandatory limit for submitting non-conventional gas extraction projects to environmental assessment was not available in these projects, and therefore most of them are not subject to this evaluation. This made the environmental and health threats from fracking technology unmonitored, and the European Commission on January 22, 2014 made recommendations on

the minimum principles required when states apply their regulations to fracking technology [44], however, these recommendations were not binding on member states. [45]

4.4. A Split Between Prohibition and Permissibility

The situation in European countries differs between a ban on production and restricted use with conditions, as cracking is prohibited in Germany, France, the Netherlands, Scotland and Bulgaria. There are other countries in which production is not prohibited, such as Denmark and England, with a difference between permissibility and effective bans between local authorities and the central authority in Hungary, Lithuania, Poland, Sweden and Ukraine.

5. The Production of Unconventional Gases and the Strategy of Developed Countries for Energy Security

5.1. Achieve Energy Security

Countries work to achieve energy security by facing impediments and restrictions imposed on the supply of energy sources. There are two main types of restrictions, the first type when the energy source becomes scarce through natural depletion, and the second type when restrictions are imposed on the supply of the energy source through artificial government efforts to reduce Of supply by imposing a ban or agreement between two producers, as well as price fluctuations, due to a change in producer policy, or that arise from a natural interruption when there is no available supply, and then the inability to meet the increased demand.

5.1.1. Maintain Power Supply from Interruption and Disruption

The role of the state is emerging as a fundamental actor in achieving energy security, and organizations such as the European Union seek to raise energy security to a supra-national level by working to reduce the conflict between the national policies of its members in the field of energy and the European Union's strategies in the field of energy supply security, especially gas supply security. Natural.

5.1.2. Shaping Energy Policy Trends

The population factor will affect the global demand for energy significantly, changing the shape of energy policies. Consumers are the ones who will shape energy policy trends through their economic level, which will be reflected in the nature of their consumption, and according to the energy projections until 2040, consumers and companies will lead a continuous development in energy needs that is shaped by them. Waves of economic growth and technological progress, and supply and demand will be affected by a wide range of government policies, whether they seek to obtain modern energy or confront climate change. [46]

5.1.3. Environment and Secure Energy Supply

The question arises, would the developed countries 'view

of the priority of energy security and their support for the expansion of the unconventional gases industry would have differed on the importance of protecting the environment, especially before the boom in shale gas production in the United States. Yes, the discussion would revolve around natural gas imports and the threats to the environment resulting from them. But the boom that occurred in the production of shale gas changed that. With the expectation of the United States to achieve self-sufficiency in gas for hundreds of years, and the possibility of becoming a pure source of liquefied natural gas, gas exports from America could form a marketing force in the coming years, with it declining environmental pledges in favor of achieving Energy security.

5.2. *A Strategy of Relying on Unconventional Gases*

The International Energy Agency estimates that gas extraction, based on fracking technology, will enable the United States to bypass Saudi Arabia and Russia in oil production, which would redraw the global energy geopolitics, as the United States is currently talking about an annual increase of 15-20% in gas production, being satisfied with a percentage 100% for natural gas, and within half a decade it will be satisfied in the field of oil, and soon it will move from import to export. [47]

The global energy market has undergone fundamental transformations, as new technological developments and climate protection policies have affected investments, consumption and trade patterns. The shale gas boom in the United States led to a significant increase in the production of petroleum products, opening the door to the export of a certain type of oil, LPG, and natural gas liquids. As a result, American companies are competing with exporters in the Middle East to win market shares, especially In Asia [48]

The rise in US natural gas exports has begun to have far-reaching repercussions, with which the dominance of the Middle East over the condensate and liquefied petroleum gas (LPG). markets will diminish. Shale oil producers in North America. [49]

6. Results

It is too early to judge unconventional gas in terms of its feasibility, as the various effects it causes are governed by technological development.

Unconventional gas is a fossil energy resource and we must resort to renewable energy sources.

Attention that about 60% of the growth in natural gas will come from unconventional resources, which are close to a third of global gas supplies by 2040, and 20% of global gas production will come from North America.

The unconventional gas activity has not yet reached a mature stage in all parts of the world, and in the medium term the United States will continue to be a pioneer in this field.

It is not likely that there will be a decline in the exploitation of unconventional gas. On the contrary, most

countries have begun attempts to exploit it.

Exploiting unconventional gas resources will change the distribution of energy resources in the world. This will change the status of importing and energy-exporting countries.

Over time, technological advances may eliminate the technical barriers to exploiting unconventional gas. In the short and medium term, however, the challenge of consuming fresh water will remain in light of its scarcity.

7. Conclusion

The fluctuations in fossil resource prices facing energy importing countries have led to the necessity to diversify energy sources. But are unconventional gases considered a suitable alternative to fossil fuels, or at least maintain the energy security of importing countries? The environmental repercussions of unconventional gases are serious. Indeed, there was an oppositional trend on the part of many European Union countries, but with the need to achieve energy security they began to change towards unconventional gases as one of the solutions to confront the Russian dominance of the European energy market.

The United States is trying to draw a new energy map at the level of the world, in light of the discovery of huge reserves of shale gas, which prevent it from importing its energy needs, and enable it to export, thanks to technologies such as horizontal drilling and hydraulic fracturing. This led to positive results that benefited the United States, the most important of which was reduced energy imports, despite the persistence of environmental concerns about hydraulic fracturing technology in Europe and the United States.

However, this boom was enabled in the United States due to the unique geological nature, in addition to the industrial, financial and regulatory factors that it enjoys. On the contrary, in the countries of the European Union, the exploitation of non-conventional resources is still a high-cost and complex process, especially in comparison to the more practical import process.

We must take into account that some environmental and public health impacts may take years to reach a fruitful applied reality, and then there is an urgent need to discuss this issue and find out what the political and technological options are to make sound strategic choices in the field of unconventional gases, where the benefits must be weighed. And the risks, as well as considering the lessons learned from the US experience, and seeking to find answers to the challenges facing the use of unconventional fossil fuels in a way that takes into account the needs of the current generation without prejudice to the future generations.

In sum, there is a need to find a kind of balance between utilizing the advantages of unconventional gases and their role in solving the energy crisis and its impact on global energy markets, and taking into account the environmental repercussions resulting from their use, in particular, of their harmful effects on water resources and land.

8. Recommendations

The need to develop non-conventional gas extraction technology to allow controlling climate change and provide the best safety and public health conditions in accordance with the principles of sustainable development.

Issuing strict laws for the exploitation of non-conventional gases to deter misuse and protect society from its bad environmental effects.

Require companies to introduce safer, environmentally friendly and transparent drilling techniques regarding chemicals used during the process.

Dependence on unconventional gases is governed by a comparison between the economic cost and the social cost. Therefore, countries suffering from scarcity of fresh water should take this into account.

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