

The World's Oil Situation: Reserves, Demand and Supply

الموارد الطاقوية الهيدروكربونية: حجم الاحتياط المؤكد

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Nassima Bousdira: The World's Oil Situation: Reserves, demand and Supply

Summary

This article attempts to answer the questions that must be asked are as follows: What, then, is the world's reserve of this precious resource? Will they be exhausted soon? Are there new discoveries of oil sources to meet the increasing global demand? What about the use of technological advances that improve productivity in the oil fields, thus contributing to an increase in global supply?

Therefore, the great challenge is that the future of global oil production will depend on a higher level of technology, innovation, large investments and exploration of lands that are currently inaccessible to develop new resources. This is the great and costly challenge that must be faced in order to meet the needs of the growing global demand for oil

Key words: Oil- Global Demand for oil- Global Supply- New Resources

ملخص:

يحاول هذا المقال الاجابة الأسئلة التي يجب طرحها هي كما يلي: ما هو إذن احتياطي العالم من هذا المورد الثمين؟ هل سيتم استنفادهم قريبا؟ هل هناك اكتشافات جديدة لمصادر نفطية لتلبية الطلب العالمي المتزايد؟ وماذا عن استخدام التقدم التكنولوجي الذي يحسن الإنتاجية في حقول النفط، مما يساهم بالتالي في زيادة العرض العالمي؟

وعليه فالتحدي الكبير هو أن مستقبل إنتاج النفط العالمي سيعتمد على مستوى أعلى من التكنولوجيا والابتكار والاستثمارات الكبيرة واستكشاف الأراضي التي يتعذر الوصول إليها حالياً لتطوير موارد جديدة. هذا هو التحدي الكبير والمكلف الذي يجب مواجهته من أجل تلبية احتياجات الطلب العالمي المتزايد على النفط

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Introduction:

Energy is the basis of almost all human activities. In the past, the most primitive humans had to consume food so that they could get the caloric energy for, for example, their hunting activities. More recently and with more complex societies, energy is needed more than ever to obtain food and water, build cities, factories, roads and so forth. In other words, the more complex and productive a society, the bigger its energy requirements. Therefore, without adequate supplies of basic fuels, particularly oil*, a complex society cannot maintain, let alone improve its industrial production and ensure a satisfactory standard of living to its population or stand up against competing powers.

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Oil, as a hydrocarbon, that is a mixture of molecules of carbon and hydrogen, results from the slow decomposition of organic matter. Although since the dawn of humanity oil had been existing under the form of seepage in different regions of the world such as China, Assyria and Alsace, it was only discovered in the early 1850s in Pennsylvania and started to be exploited in other parts of the world such as Romania.⁽¹⁾

Oil was first used as Lubricant then, thereafter, it was realized that light oil could be extracted from it, in the form of kerosene as fuel for lamps. Kerosene, as an oil-product used mainly to illuminate lamps gave rise to the first big market for common industrial products.

Thereafter, oil played a major role as fuel for combustion engines produced in the car and ship industries. In 1911, the British Royal Navy, under the leadership of Lord Winston Churchill replaced Welsh coal by imported oil to gain speed on enemy fleet.⁽²⁾ It was

* - The terms oil, crude oil, petroleum and hydrocarbons will be used interchangeably.

⁽¹⁾-Bruno Roberge, Le pétrole de l'origine à l'extraction, Cégep de Félicien, octobre 2010, p. 6

⁽²⁾--Jean-Marie Chevalier, Les 100 mots de l'énergie, (P.U.F. Que sais-je ? , 2010), P. 103.

particularly during the First World War that oil emerged as a strategic material with the use of tanks and trucks that replaced horses.

With the passage of time, the world oil market got organized, first under the control of major international companies, the "Seven Sisters"* then, subsequently and gradually, came under control of OPEC**, the first producer attempt to institutionalize coordination and materialize the demands and interests of major oil producing and exporting countries.

Oil production goes up rapidly as transportation means get developed. Nowadays, oil stands up as the dominant energy in the world's energy consumption. So, the questions to be asked are as follows: what, then, of the world reserves of this precious resource? Will they soon be exhausted? Are there any new discoveries of oil resources to meet the growing world demand? And what about the use of technological progress that improves productivity in Oilfields, contributing, thus, to the increase of world supply? To answer these questions, the first section of this chapter is devoted to describing the world's oil reserves available. The second section will be dealing with

* - The Seven Sisters represent the seven international oil companies that had dominated the world oil market from the early twentieth century to the early sixties. They are as follows :_The Anglo-Persian Oil Company (United Kingdom); This company subsequently became Anglo-Iranian Oil Company and then British Petroleum (BP); The Gulf Oil (United States): In 1984 most of Gulf was acquired by Standard Oil Co. of California (SoCal) which in turn became Chevron; Royal Dutch Shell (Netherlands/United Kingdom); Standard Oil of California (SoCal)(United States) which, as stated just before, took the name of Chevron in 1984; Sandard Oil of New Jersey (Esso) (United states): Subsequently became Exxon, then ExxonMobil following the acquisition of Mobil in 1999; Sandard Oil Co. of New York(Socony) (United States): Subsequently became Mobil, which was acquired by Exxon in 1999 to become ExxonMobil; Texaco (United States): Acquired by Chevron in 2001.

** - OPEC (Organization of Petroleum Exporting Countries) The OPEC has 12 oil exporting countries: Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela. It should be noted that the number of OPEC members changed over time. In 2009, Indonesia, for instance, had to suspend its membership because of its increasing oil demand at home. Gabon had to leave the organization because it was not allowed to pay a lower membership fee. OPEC members account for about 44% of world oil production and 70% of world crude oil reserves.

the world's oil demand that reflects changes in global growth and the third section will be devoted to an overview of present and future oil supply worldwide.

1) The Geographical distribution of the world's oil reserves

Crude oil reserve estimates are the amount of recoverable oil from oil fields discovered. In other words, only, those parts of oilfields that are considered sufficiently developed and technically and economically accessible count as recoverable and proved reserves. This means that on average only 35 percent of the oilfield is recoverable. This also supposes that this rate could increase in the future with the technological progress. Therefore, new techniques would enable a better mining of known reservoirs, which only 35 percent of their actual stock is extracted.⁽³⁾

In addition to the recoverable and proved reserves, there is what is called 'probable and possible reserves'. These are related to new discoveries that could be made in the future as a result of investment in mining exploration along with the evolving technology.

The proved oil reserves throughout the world are, as we shall see, geographically distributed very unevenly. "This makes of it" as Philippe Copinschi said "the subject of harsh strategies of appropriation by private companies and producers or consumers states alike"⁽⁴⁾.

a) The Middle East

According to the 2010 figures, the Middle East alone concentrates 56.6 per cent of oil reserves.⁽⁵⁾ The OPEC organization holds 75 percent of global oil reserves. Among OPEC members, Saudi Arabia, Kuwait, Iran, Iraq and the United Arab Emirates altogether represent more than three-fifths of the world's oil reserves.

⁽³⁾- Ibid., p. 25

⁽⁴⁾- Philippe Copinschi, cited in El Watan 22-10-2012

⁽⁵⁾- Ludovic Mons, Les enjeux de l'énergie : Pétrole, nucléaire et après .? Petite encyclopédie Larousse, 2011, P. 42.

Saudi Arabia with its 28 million inhabitants has the largest oil reserves in the world. It accounted for 22.5 percent, in 2007.⁽⁶⁾ Moreover, its oil deposits are easily exploitable and have the characteristic of being highly flexible because production can be regulated according to the world context.

b) Russia

The former Soviet Union possesses 9 percent of global oil reserves that is 16.7 billion tonnes. Russia, for its part, accounts for 10.2 billion tons and has the world's seventh largest oil reserves.⁽⁷⁾

c) China

As far as China is concerned, its share of the world oil reserves is negligible. It stood at a mere 2.3 percent, in 2003 and 1.3 in 2007.⁽⁸⁾

d) The Caspian Sea region

The Caspian Sea* region possesses important oil reserves located offshore in the Caspian Sea itself and onshore in the oilfields of the region. According to the U.S. Energy Information Administration**, in 2012, the Caspian Sea and surrounding region's proved and probable reserves of oil stood at 48 billion barrels. Offshore fields accounted for 41% of total Caspian crude oil.⁽⁹⁾

Regarding Kazakhstan and according to the Kazakh Ministry of Energy and Mineral Resources, its proved reserves accounted for 17.8 billion barrels and its estimated reserves are between 30 and 50

(6)- Jean-Pierre Favennec, Géopolitique de l'énergie, IFP Training School, 2008, p. 7.

(7)- Mons, les enjeux de l'énergie, op-cit., p. 53

(8)- Jin Zhang, , Catch-up and Competitiveness in China : The Case of Large Firms in the Oil Industry, Routledge Curzon London, 2004, pp. 163-164).

* - To recall, the Caspian Sea is an inland body of water. It lies between South Caucasus (formed by Azerbaijan, Georgia and Armenia) and northern Iran. Its neighbouring countries are Kazakhstan, Turkmenistan, Iran, and Azerbaijan.

** - The EIA is part of the US department of energy.

(9)- US Energy Information Administration, U.S. Geological Survey, IHS, EDIN, September 11, 2013

billion barrels.¹⁰⁾ Russia, for its part, holds the 1/40th of proved reserves on the periphery of this landlocked sea.

As far as Iran is concerned, 10 percent of its oil reserves are situated offshore. It started exploiting its Caspian oil fairly recently.⁽¹¹⁾

e) Africa :

i)North-Africa:

In North-Africa, north of the equator, oil reserves are mainly located in Libya which accounts for 3.3% of world reserves, and Algeria 1 percent. It is estimated that Algeria's oil reserves correspond to eighteen years duration.⁽¹²⁾ Libya and Algeria are both members of OPEC. Egypt, for its part, represents 0.3 percent of world reserves. Altogether, these three countries accounted for 5 percent of the world production of oil in 2004.⁽¹³⁾

ii) Sub-Saharan Africa:

Regarding Sub-Saharan Africa, the Gulf of Guinea accounts for only 5 percent of global oil production. With the recent discoveries of large offshore deposits, the Gulf of Guinea has a high potential for oil production.⁽¹⁴⁾

f)-The North Sea

The North Sea is situated on the continental shelf of north-western Europe. It is bordered by the United Kingdom (UK), Norway, Sweden, Denmark, Germany, the Netherlands, Belgium, and France. Oil is mainly produced in the Northern part of the sea, that is to say in the United Kingdom (UK) and Norway. The North Sea stretches over 700,000 kms and its depth varies between 95 meters in the southern

(10)- Victor Chkolnik's declaration, Kazakh Ministry of Energy and Mineral Resources, at the London conference, in July 2002 in Betsy Annen, Marion Badot, Nadine Livrozet, Claude Mounier, Emmanuel Mourlon-Druol, Hélène René, Karim Sader, **Géopolitique de l'énergie : risques et enjeux pour la Défense**, Direction de la recherche Colomban Lebas, CHEM-CEREMS, Ministère de la Défense, 1er juillet 2006, p.43

(11)– Ibid.

(12)- **El Watan** 29 Septembre 2012

(13)- Annen, Badot, Livrozet, Mounier, Mourlon -Druol, René ,Sader, Géopolitique de l'énergie, op - cit., P. 39.

(14)- Ibid., P.26

region and 700 meters in the northern part along Norway. Major discoveries of oil were made in the 1970s.⁽¹⁵⁾

As far as the UK is concerned, its oil reserves account for approximately 20 billion barrels and their exploitation seems complex and difficult. In this connection, the Rosebank field discovered in 2004, located offshore of the Shetland Islands is regarded as one of the most challenging fields.⁽¹⁶⁾ It is estimated to hold about 240 million barrels of oil equivalent. Another “heavy” oil field the extraction of which is also difficult is Kraken which is located 78 miles east of the Shetland Islands.⁽¹⁷⁾

Regarding Norway and according to Oil and Gas Journal (OGJ), Norway’s proved oil reserves amounted to 8.5 billion barrels in 2005, the largest in Western Europe.⁽¹⁸⁾

g) America

i) North America:

The United States and Canada, as we shall see later, most of their reserves are made up of unconventional oil* in the form of oil sands, shale oil and tight oil. In the United States proved reserves of oil rose by 2.9 billion barrels in 2010 and reached 29 billion barrels in 2011.⁽¹⁹⁾ Shale oil and tight oil (oil of very low permeability), thanks to the application of new technologies have contributed greatly to

⁽¹⁵⁾- Chevalier, **Les 100 mots de l’énergie**, op-cit., p. 103.

⁽¹⁶⁾- ‘Chevron throws doubt on Rosebank North Sea’, **Irish Times**, November 23, 2013.

⁽¹⁷⁾- ‘EnQuest to lead £4 bn North Sea Investment Oil’, **Telegraph**, November 15, 2013.

⁽¹⁸⁾- ‘Norway Oil Reserves and Oil Production’, **Oil and Gas Journal**, March 19, 2006

* - Unconventional oil is oil extracted using techniques different from those of the conventional method (consisting in drilling a hole in the earth's surface and rock layers to extract oil).

Among unconventional oils, we find extra heavy oils which are extremely viscous and solid at room temperature; oil sands, a form of heavy oil, composed of viscous bitumen locked in sand and clay; oil shale derived from sedimentary rocks that contains important amounts of organic material and tight oil, obtained from other types of sedimentary rocks with low permeability.

⁽¹⁹⁾- **US Energy Information Administration Report**, August 1, 2013, p.6

increases in their oil proved reserves. On November 12th the International Energy Agency (IEA), the rich world's energy club, predicted that the United States could emerge as the world's largest oil producer by 2020, overtaking Saudi Arabia and Russia. It could also achieve self-sufficiency in energy by 2035.⁽²⁰⁾

As far as Canada is concerned 170 billion barrels of oil are expected to be recovered economically thanks again to the advances in technology from its oil sands reserves. This makes of Canada the world's third-largest proved oil reserves, after Saudi Arabia and Venezuela.⁽²¹⁾

ii) Latin America:

Latin America's proved reserves in the region account for 13 percent of the world oil reserves of which 64.6 percent is located in Venezuela and 19 percent in Mexico.⁽²²⁾

In 2011, Venezuela's oil's reserves accounted for 211 billion barrels of proved oil. With the inclusion of the large reserves of heavy oil in Venezuela's Orinoco belt, reserves are even bigger at 316 billion barrels.⁽²³⁾

The different figures and data provided up to here, regarding the world's hydrocarbons reserves, are collected and published by a number of organizations which are mainly Anglo-Saxon organizations (United States Energy Information Administration (EIA), the International Energy Agency (IEA), British Petroleum BP statistics, Oil and Gas Journal and so forth). These organizations get all data and values from ministries and oil companies.⁽²⁴⁾ These figures help calculate the number of years left ahead to use the resource of oil, or what is called the famous ratio in years: Reserve/Production (R/P. This ratio in years is obtained when we divide the amount of proved reserves by the annual production or consumption of oil.

⁽²⁰⁾- "America's oil bonanza", Economist, November 17, 2012

⁽²¹⁾- Fort Mc Murray, "The Sands of Grime", Economist, November 17, 2012

⁽²²⁾- Annen, Badot, Livrozet, Mounier, Mourion--Druol, Rene, Sader,

Géopolitique de l'énergie, op-cit., pp. 3 & 49.

⁽²³⁾- U. S. Energy Information Administration, 3 October 2012, p. 2.

⁽²⁴⁾- Yves Mathieu, "Les réserves mondiales d'hydrocarbures", Géologues No 144, p. 25

In this context, in 1973, at the time when the first oil crisis struck, the ratio recoverable reserve / annual consumption was thirty years. Others more pessimistic predicted that “in thirty years there would be no more oil. Now, after forty years of almost continuous growth of consumption, world oil reserves correspond to forty or forty- five years of production.”⁽²⁵⁾

What is the reason for that? The answer is very simple. It happens that in the meantime, significant progress has been realized that allowed to go farther and search in difficult areas, such as deep offshore zones and thus increases recovery rates. In this connection, in early 2010, the figure of proved recoverable reserves of oil was 205 billion (toe)* ⁽²⁶⁾ and were estimated, as mentioned earlier, to represent forty-six years of use at current consumption rates. However, this does not imply that oil reserves will be depleted within the next forty years because they can be increased thanks to new discoveries, and technological advances that improve the productivity of the oilfields. When a field is discovered for the first time, usually, there is little information regarding its reserves.

As the field is developed overtime, thanks to the application of new techniques, better knowledge is discovered about its reserves and production. In this way, proved oil reserves are very often augmented and the difference that could exist between the time of discoveries, and that of revisions and additions could be considerable. So, the world’s proved oil reserves representing forty-six years of use in 2010, could cover roughly another twenty years beyond that, if potential reserves are counted.⁽²⁷⁾

One day, the oil production is bound to reach what is called the “peak oil” that is to say, the time when global production reaches its maximum level and, thereafter, starts declining. For the time being the

⁽²⁵⁾- Jean-Michel Gauthier, ‘**Géoeconomie de l’offre et de la demande énergétique mondiale**’, *Géoeconomie*, Editions Choiseul, 2009/4 - N° 51, p. 40.

* - The tonne of oil equivalent (toe) is a unit of energy, the amount of energy released by burning one tonne of crude oil. (A tonne of oil is equivalent to 7.3 barrels of oil)

⁽²⁶⁾- Chevalier, **Les 100 mots de l’énergie**, op-cit., p. 26.

⁽²⁷⁾- Daniel Yergin, **The Quest: Energy, Security, and the Remaking of the Modern World**, The Penguin Press, New York, 2011, p.26

world is not running out of oil, thanks to the existing reserves and the demand for it keeps increasing.

2) An increasing demand reflecting shifts in global growth

Over the last fifty years the global primary energy* demand structure has been dominated by oil for more than 80 percent and is also expected to cover the same percentage of the world's energy needs over the next 25 years.

a) A high demand maintained

As far as the structure of global demand for oil is concerned, transport needs take 57 percent of it whereas they stood only at 38 percent in 1979, during the second oil shock, with a shortfall in oil supply resulting from the troubles in Iran. More than 80 percent of these 57 percent go to the road and air transport sectors, and two-thirds of this amount, that is 22 Million barrels per day or the equivalence of more than twice the daily production of all Saudi Arabia, fills the car tanks throughout the world.⁽²⁸⁾

Another energy-intensive sector is that of industry, particularly those large energy-consuming industries such as steel, aluminium, cement and other construction materials. Firms in these sectors consume a lot of energy either as a source of energy such as heat or as raw materials such as naphtha, a by-product of oil, especially in the petrochemical industry.⁽²⁹⁾

In 2030, it is expected that global demand for oil will reach the equivalent of 106 million barrels per day. With such a long-term growing demand of energy, much stress will be put on oil

* - The primary energy is an energy that exists naturally and has not undergone any transformation by human beings. One example of this is oil, a non-renewable resource, and solar energy as, renewable resource.

⁽²⁸⁾- Gauthier, **'Géoéconomie de l'offre et de la demande énergétique mondiale'**, op -cit., p. 37.

⁽²⁹⁾- Chevalier, **Les 100 mots de l'énergie**, op-cit., pp. 5 & 29

production.⁽³⁰⁾ The United States, for example, which used to be a major energy –producing and exporting country but also a major energy- consuming country has become, in the late 1950s and since the 1970s, a net importer of oil. The United States dependence on imported oil has been growing steadily over the years and by the year 2000 was up to 55 percent of total demand. The American Department of energy has forecast an increase in net imports to nearly 70 percent of demand by 2025.⁽³¹⁾

As far as Europe, as a whole, is concerned, it remains dependent on oil imports. These are expected to rise from 50 to 70 percent by 2030.⁽³²⁾ France, for its part depends heavily on imports for oil, making it particularly vulnerable to price increases. France, altogether with Germany and Italy account for about half of total European Union imports for crude oil.

On the other hand, Japan's economic development has been realized mainly with imported oil.

If the last century was characterized by a world demand which was mainly concentrated in developed countries like the United States, Western Europe and Japan, the twenty-first century, has brought a change in the world economy such as globalization of demand with new emerging nations like China. If the demand has become global, this, of course, is going to add to the upward pressure on demand as a result of increased industrial and domestic demand for power generation and transportation.⁽³³⁾

Unlike the 1970s and the "supply shock" following the 1973 oil crisis, the 2000s have experienced a form of "demand shock".

b) The new "demand shock" or higher oil demand

The end of the cold war and the advent of globalization brought in a new era with radical shifts in global demand. With the

⁽³⁰⁾- Gauthier, "Géoéconomie de l'offre et de la demande énergétique mondiale", op -cit., pp. 36-37-

⁽³¹⁾- Francisco R. Parra, Oil Politics: A Modern History of Petroleum, I.B. Tauris, London 2004, p. 344.

⁽³²⁾- Chevalier, Les 100 mots de l'énergie, op-cit.,p. 99.

⁽³³⁾- Klaus Dodds, Geopolitics: A very short introduction, Oxford University Press, 2007 p. 77

increasing effect of the globalization and the structural rise in world demand as a result of rising living standards in the emerging economies (China and India*, for example), the predominance of the developed countries has been declining. Although the world demand for oil witnessed an increase of 25 percent between 1980 and 2000, the developed countries have still been consuming the same amount of oil; that is to say two-thirds of global oil since the beginning of the new century.

In 2004, world demand for oil increased sharply. Prices went up largely, not because of a shortfall in oil supply as it was the case during the first and second oil shocks due to the embargo imposed by OPEC countries and the disruption of oil supply following the troubles in Iran, but rather because of an increase in demand.

Similarly, between 2000 and 2010, the global demand for oil went up by 12 percent. But this time the distribution in world oil demand between the developed and the developing countries was 50-50.⁽³⁴⁾ This is a different situation from the 1973 and 1979 oil shocks which physically disrupted the supply of oil, depriving consumers of this vital commodity. That situation was there to recall the developed countries that they have simply to share the increased supply with newly emerging nations.

The new demand shock or higher oil demand resulted from the strong economic growth experienced by China coupled with its growing demography which translated into higher demand for oil. China's coal, the country's main source of energy, simply could not meet its growing demand for primary energy. China had to import about 1.5 million barrels per day, in 2000.⁽³⁵⁾

* - In India, because of its economic growth and limited resources available, oil accounts for 24 per cent of its overall energy consumption. It imports 70% of its oil and petroleum products which makes it increasingly dependent on imported energy. On top of that, It is estimated that in the near future, that is in 2030, India's population is going to overtake that of China to reach the figure of 1.4 billion people.

⁽³⁴⁾- Yergin, **The Quest**, op-cit., p. 76

⁽³⁵⁾- Parra, **Oil Politics**, op-cit., p.317

All in all, oil demand in China grew from 5 to 6 percent in 2000, to 16 percent in 2004. Also, between 1999 and 2002, it grew to 1.4 million barrels per day. Between 2003 and 2006, the demand shock reached 4.9 million barrels that is nearly four times as much. And it is assumed that by 2025, its imports will stand at 11 million barrels of oil per day; that is to say, an increase of 6 million barrels per day from 2005.⁽³⁶⁾

Since the 1973 oil embargo and the 1979 disruption of oil supply, following the Iranian revolution, and more recently the growing demand from the emerging nations, the fear of permanent oil shortages has led to a frantic search for new supplies and development of new resources.

3) Ensuring the supply

In order to secure oil supply in the face of the global growing demand, new provinces and areas of oil, as we shall see later, have been discovered such as in the Alaska's North Slope and the North Sea and put into operation.⁽³⁷⁾ Furthermore, the development of the use of new technologies, as stated earlier, have contributed greatly to inducing an improvement in the rate of oil recovery of the already existing reserves by turning that portion of proved reserves of oil, which was physically inaccessible or economically too costly, into recoverable.

As mentioned previously, only 35 percent of an oil field is produced with the traditional methods. The new technology helps increase production from existing fields and identify new resources, contributing thus, through this considerable amount of additional oil, to the growth of global oil supplies.⁽³⁸⁾

According to the United States Department of Energy (DOE), oil is still the world's most important source of energy. It provided 35 percent of the world's primary energy supply in 2007 and is likely to

⁽³⁶⁾- Yergin, The Quest, op-cit., p. 77

⁽³⁷⁾- Ibid., p. 108

⁽³⁸⁾- Leonardo Maugery, "Amid warnings of a possible peak for oil production, new technologies offer options to extract every last possible drop", Scientific American, 1 April, 2009, pp. 2-3

provide the same amount in 2035.⁽³⁹⁾ Present and future expectations reckon an increase in the production capacity of oil going from approximately 93 million barrels per day in 2010 to about 110 million barrels per day by 2030. That is roughly 20 percent increase.⁽⁴⁰⁾

The achievement of that level of oil production presently and by 2030 is expected to come from the Middle East which remains the key area for oil supplies, and then Russia. It also implies the development of new, and more challenging and complex resources* located in Central Asia (the Caspian Sea), Africa (Gulf of Guinea), Europe (the North Sea), and America (both North and South).

The realization of such a goal requires a widening of the definition of oil in order to take into account what are called non-traditional or unconventional oils. These unconventional oils, as we shall see subsequently, are a substantial part of the world's future oil supply.

a) The Middle East

The Middle East remains the traditional and the key area for oil supplies with its major oil reserves (56.6 percent of world oil), as mentioned earlier, and thus the coverage of needs of many countries, particularly the emerging ones such as China and India, because of their strong economic growth.

In 2025, it is expected that two-thirds of the rise in world output required will come from OPEC countries, particularly the Middle East and most of that from Saudi Arabia.⁽⁴¹⁾ The Middle East is also the only remaining area where production capacities are

⁽³⁹⁾- Michael T. Klare, "Energy security" in **Security Studies: An Introduction**, (2nd edition, Edited by Paul D. Williams, Routledge, London & New York, 2013), p. 536.

⁽⁴⁰⁾- Peter Jackson, Jonathan Craig, Letha Smith, Samia Razak and Simon Wardell, "Peak Oil": Postponed Again" **IHS CERA**, October 2010 & Yergin, **The Quest**, op-cit., 112

* - According to the International Energy Agency (IEA), the development of new resources amounts to \$ 8 trillion over the next quarter century. See. International Energy Agency **World Energy Outlook 2010**, International Energy Agency, Paris: 2010, p. 139.

⁽⁴¹⁾- Parra, **Oil Politics**, op-cit., p. 344

available and could be mobilized on short notice, to fluctuations in demand. Saudi Arabia, in this context, plays a regulatory role in world oil supply as it did when production decline occurred in Iraq because of the United States invasion in 2003. Oil shortfall was compensated by a significant increase in Saudi production.⁽⁴²⁾

In addition, the cost of oil production is very low. It amounts to a few dollars only. In Saudi Arabia, for example, in 2008, the cost of production (excluding investments such as the capital cost) did not go beyond \$ 5 per barrel for a price exceeding \$ 90, on average*. On top of that, Saudi Arabia has the largest oil field in the world, the Ghawar field, made up of five fields, in operation since 1948.⁽⁴³⁾ The latest or fifth field went into production only in 2006. Ghawar continues to produce 5 million barrels per day thanks to the use of new technology that continues to release new oil resources, thus contributing to increasing world supply of oil and meeting the growing demand.

b) Russia

Apart from the Middle East stands another major producer of oil: Russia. Russia became the first largest producer of oil with 10.03 million barrels per day in 2006, the second largest producer being Saudi Arabia with 9.7 million barrels per day.⁽⁴⁴⁾

⁽⁴²⁾-Chevalier, **Les 100 mots de l'énergie**, op-cit., p. 92

* - Oil is the only commodity whose price can be higher than the cost of production. In our example, about Saudi Arabia, the cost of production amounts to \$5, for a price exceeding \$ 90. In other areas of oil production, the cost of production varies between \$5 (like in Saudi Arabia) and \$ 50 (in other regions) per barrel for a price of \$ 90. The absolute oil rent for all producers is thus \$40 that is \$90 minus \$ 50. Saudi Arabia, for its part gets an additional oil rent of \$ 45, that is 50 minus 5. So Saudi Arabia's total oil rent amounts to \$ 85. For further details, see Jean-Pierre Favennec, **Géopolitique de l'énergie : besoins, ressources, échanges mondiaux**, Editions Technip Paris:, 2009, p. 5.

⁽⁴³⁾- Matthews R. Simmons, **Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy**, Hoboken: John Wiley, 2006, p. 19 & also Jean-Pierre Favennec, **Géopolitique de l'énergie : besoins, ressources, échanges mondiaux**, Editions Technip, Paris:2009, pp. 32 & 59

⁽⁴⁴⁾- Mons, **les enjeux de l'énergie**, op. cit., p.53

c) Central Asia

In order to meet the ever-increasing demand, oil supply from new areas has been brought into the global market. In this context, the Caspian Sea region stands as one of the largest suppliers of hydrocarbons. It accounts for 5 percent of the world oil supply.

Although the exploitation of energy resources of the seabed has been hampered somewhat by the prevailing conflicts in the region, the Caspian Sea still remains an important supplier with its 2 to 6 percent of oil reserves. This potential of oil would help cope with the growing need especially since it is expected that in 2020, the Caspian Sea region will possess the third-largest producing field of oil.⁽⁴⁵⁾ According to the Energy Information Administration (EIA)'s report, in 2012, the oil production of the Caspian Sea region averaged an amount of 2.6 million barrels per day, that is about 3.4 percent of the global world supply.

Kazakhstan is the biggest contributor to the region supply thanks to its onshore oilfields, particularly the Tengiz field.⁽⁴⁶⁾ Moreover, the discovery, in 2000, of Kashagan,* one of the largest oil fields in the world, outside the Middle East, with an estimated 16 billion barrels of oil reserves, could add about 1.5 million barrels of oil a day to world supply, that is to say Kashagan's oil output will amount to about 1.6 per cent of the world's oil supply or approximately the production of Libya.⁽⁴⁷⁾ In 2015, Kazakhstan's production is expected to rise to 150 million tonnes.⁽⁴⁸⁾

⁽⁴⁵⁾- Yergin, **The Quest**, op-cit., p. 30

⁽⁴⁶⁾- **US Energy Information Administration**, U. S. Geological Survey, IHS, EDIN, September 11, 2013.

* - A consortium that includes ConocoPhillips, Exxon Mobil, French energy company Total, the national energy company of Kazakhstan, KazMunayGas, Royal Dutch Shell and the Japanese oil company Inpex are operating in the Kashagan oil field the production of which is expected to meet the world's rising oil needs.

⁽⁴⁷⁾- **New York Times**, Andrew A. Kramer, Sep 11, 2013

⁽⁴⁸⁾- Annen, Badot, Livrozet, Mounier, Mourion--Druol, Rene, Sader, **Géopolitique de l'énergie**, op-cit., p. 42

Regarding Azerbaijan, 90 percent of its oil production is located offshore. With the development of the Azeri-Chirag-Guneshli (ACG) field group in the late 2000s, its offshore production contributed in a substantial way, to rising global Caspian production in oil and is expected to reach 2 million barrels by 2020.⁽⁴⁹⁾

Near the coast, Turkmenistan's production reached 200,000 barrels per day, in 2004 and is expected to get at 100 million tonnes in 2020.

In North's Caucasus region, Russia is an important producer of Caspian oil.⁽⁵⁰⁾

d) Africa

New resources are discovered in Africa. This continent is on track of becoming a major actor in the oil market, supplying the major consuming countries such as the United States, Europe and China.

i) North Africa

In North Africa, Algeria, an OPEC country member has doubled its production of oil. It increased from about 750,000 barrels per day in the late 1990s to 1.4 million barrels in early 2000s, thanks to the development of production from several discoveries. In this connection a new oil field El Merk** has been discovered recently in the Berkin basin, former Ghadames in the wilaya of Illizi, located a hundred kilometres from the Libyan border, and in operation since 1998.

El Merk's proved oil reserves are estimated at 1.2 billion barrels, of which nearly 40% (647 million barrels) is thought recoverable.⁽⁵¹⁾

The new oil field, has already reached the production level of 83,000 barrels per day, contributing thus to increasing the overall

⁽⁴⁹⁾- Ibid., p.43

⁽⁵⁰⁾- **US Energy Information Administration**, September 11, 2013, op-cit.

** El Merk oil field has been developed in partnership with the national oil company Sonatrach, and the international companies, American Anadarko and its partners ENI, Maersk, Conoco Philips and Talisman.

⁽⁵¹⁾ - "Gisement d'El Merk Illizi": Le ministre de l'Énergie inaugure officiellement les installations pétrolières", **Horizons**, 27 octobre 2013.

production of the Berkin basin more than 300,000 barrels per day, that is the second largest oil production after that of Hassi Messaoud, the largest oil field in Algeria.⁽⁵²⁾ El Merk is expected to produce 146,000 barrels per day in the near future.⁽⁵³⁾

El Merk mining project includes the development of another four oil fields: El Merk, El Khit Timissa, El Merk and El Merk North East.

According to the Minister of Energy and Mines during a brief press conference held after the inauguration of the El Merk project, in October 2013, "The project gives Sonatrach, the Algerian company, an additional oil production capacity of approximately 100,000 barrels per day".⁽⁵⁴⁾ In addition, the development of the exploitation of unconventional hydrocarbons should also be supported in legislation, given the important reserves available in Algeria.

ii) Sub-Saharan Africa

In Sub-Saharan Africa, the Gulf of Guinea constitutes another promising source of oil supply because of its important growth of production and in this regard tends to attract important international investment: Chevron Texaco, for example, has been operating mainly in Angola but also in Nigeria and Congo Brazzaville; ExxonMobil in Nigeria, Angola and Equatorial Guinea.⁽⁵⁵⁾

The largest producer in the region is Nigeria.⁽⁵⁶⁾ It produced 2.5 Mb/d (million barrels per day) in 2004, the equivalent of 3.2 percent of world production of oil and 28 percent of African oil production. Moreover, the recent discoveries of large offshore deposits will contribute to increasing its production even more.

The second largest producer in the region is Angola with 0.99 Mb/d; then come Equatorial Guinea with 0.35 Mb/d, Congo Brazzaville with 0.24 Mb/d, Gabon with 0.23 Mb/d and Cameroon with 0.062 Mb/d. Sudan, on the other hand, produces 300,000 b / d. It

(52)- 'La production a atteint 83 000 barils par jour'', **El Watan**, 28 octobre 2013

(53)- **Horizons**, 27 octobre 2013 op-cit.

(54)- Ibid.

(55) - Simon Robinson "Black gold", **Time Magazine**, 20 October, 2002 & Annen, Badot, Livrozet, Mounier, Mourlon-Druol, René, Sader, **Géopolitique de l'énergie**, op-cit., p. 26

(56) - **BP Statistical Review of Energy**, June 2005, p. 6

has been experiencing political turmoil. This has contributed to hampering seriously its oil production. Chad's production, for its part is expected to increase in the future.⁽⁵⁷⁾

e) Europe

Currently, almost 30 percent of global oil output, that is 26 million barrels per day, is produced offshore in both shallow and deep waters. The global deepwater oil production in 2010 accounted for approximately six million barrels per day, a quantity that overtakes that of any country but Saudi Arabia, Russia, and the United States. It is expected that deepwater production will attain 10 million barrels, in 2020. Deepwater production is one element of what is called unconventional supply. And the North Sea is one example of this.

Oil production from the four North Sea countries (Norway, the UK, Denmark, and the Netherlands) stood at 3.354 million barrels a day (b/d) in 2011, that is a decrease of 9.4% in comparison with 2010. Since the 2000s, the UK* has been experiencing a steady decline of its oil production losing 17.5 percent to average 1.068 million b/d and it is very likely that it will go down even further throughout 2013 because of its aging production infrastructure.⁽⁵⁸⁾

It is expected that in the coming few years, new investment will contribute to bringing a rebound in production from under 1.5million barrels of oil a day to 2million, according to Oil & Gas UK, a trade body.⁽⁵⁹⁾

Norway, for its part, is the world's eighth-largest oil exporter.⁽⁶⁰⁾ Norway exports 90 percent of its oil production and as

⁽⁵⁷⁾- Ibid.

* - UK's crude oil is light (30° to 40° API (API stands for American Petroleum Institute Gravity or API gravity which is a measure of how heavy or light a petroleum liquid is compared to water) with a low sulphur content. Brent is used as a reference index for the European market. A big part of the crude is traded at the London Stock Exchange.

⁽⁵⁸⁾- 'North Sea: Optimism and Alarm Bells', **Petroleum Economist**, March 6, 2012.

⁽⁵⁹⁾- 'North Sea Oil: Drill, Maybe, Drill', **Economist**, May 4, 2013).

⁽⁶⁰⁾- 'Norway, the Rich Cousin. **Economist**, February 2, 2013.

such, stands as the third largest oil-exporting countries, before several OPEC countries.⁽⁶¹⁾

f) America

i) North America

In addition to deepwater production, one element of non-traditional supply, there is also the opportunity to exploit oil sands, shale oil and tight oil, other elements of what is called unconventional supply that can provide the supplement or the alternative for the conventional oil shortage. In this connection, oil sands, appears as one of the major sources of new supplies in both Canada and the United States.⁽⁶²⁾

Canada stands as the fifth-largest oil-producing country in the world. Its oil sands are located mainly in the Athabasca region, in the northern part of the Canadian province of Alberta⁽⁶³⁾. Oil sands, to recall, are a form of heavy oil, composed of viscous bitumen locked in sand and clay. That is what, unlike conventional oil, makes its commercial extraction difficult. The cost of mining oil sands is among the highest ones. It is estimated that Canada could have, in the form of oil sands reserves, the equivalent to those of Saudi Arabia. But while Saudi Arabia can produce these reserves very easily at a rate of 10 million barrels per day, Canada will only produce 2 million barrels per day.⁽⁶⁴⁾

Thanks to the advances in technology, the production of oil sands went from 600,000 barrels per day in 2000 to about 1.5 billion barrels per day in 2010. It is expected to double by 2020, with 3 million barrels per day (mbd), overtaking the present oil production of either Venezuela or Kuwait. Taking account of its conventional production, Canada could arrive at 4 mbd by 2020⁽⁶⁵⁾.

However, the major drawbacks of oil sands in terms of new oil development are the impact on the environment. The extraction of hydrocarbons from these heavy oils presents the inconvenience of

⁽⁶¹⁾- Mons, Les enjeux de l'énergie, op-cit., p. 43.

⁽⁶²⁾- "Oil in America", Economist, November 17, 2012.

⁽⁶³⁾- Yergin, The Quest, op-cit., p. 118

⁽⁶⁴⁾- Chevalier, Les 100 mots de l'énergie, op-cit., .39

⁽⁶⁵⁾- Yergin, The Quest, op-cit., p. 119,

being highly polluting regarding the environment and the atmosphere. As mentioned earlier, It requires the implementation of complex and costly technologies. Nevertheless, given the fact that the high price of oil is set at an average of \$ 100 per barrel like in 2013⁽⁶⁶⁾, this could enable the laboratories of majors (that is international oil companies), to carry out research in an attempt to find out a way to reduce the level of pollution released by these new sources of energy to that of oil.

Another kind of unconventional oil is oil shale. Oil shale is locked in rocks containing important amounts of organic material called kerogen. Kerogen is the precursor to oil. Oil shale resource is plentiful: 8 trillion of which 6 trillion are located in the Rocky Mountains, in the United States.⁽⁶⁷⁾

A new resource of unconventional oil is what is called tight oil. Tight oil is locked in other types of sedimentary rocks with low permeability. It is found in the Bakken formation, stretching below the Williston Basin across North and South Dakota and Montana, in the United States and Saskatchewan and Manitoba in Canada. Thanks to advances in drilling and recovery technology such as horizontal drilling and hydro-fracturing, tight oil production in the Bakken went from less than 10,000 barrels per day in 2005 to more than 400,000 barrels in 2010. It is expected to reach 800,000 barrels per day or even more for decades⁽⁶⁸⁾ and make a major contribution to the energy independence of the United States.

Similarly, other formations such as the Eagle Ford in Texas, Bone Springs in New Mexico, and three Forks in North Dakota, are considered to be potential producers of tight oil that could attain two million barrels per day of additional production in the US by 2020.⁽⁶⁹⁾ Unconventional oil particularly, shale oil boom is turning North America into one of the world's largest oil producer with the United

⁽⁶⁶⁾- ‘‘Oil Prices: The Triple-digit Barrel, Are High Prices Here to Stay, **Economist**’’, 15 June 2013 & Frédéric Encel , ‘Le pétrole du Moyen Orient est-il géopolitiquement si précieux? Réflexion autour d’une contestable centralité économique, stratégique et énergétique’’, **Management et Avenir**, 2012/2-no 42, pp. 291-292

⁽⁶⁷⁾- yergin, **The Quest**, op-cit., p. 121

⁽⁶⁸⁾- Ibid., pp. 121-122

⁽⁶⁹⁾- Ibid. p.121

States in the first position and Canada following suit . That important share of oil, produced by North America, could drastically modify the economics and politics of oil in the near future.⁽⁷⁰⁾

ii) Latin America

Latin America accounts for 15 percent of world oil production and consumes only 8.5 percent of the world total. It exports 48 percent of it to neighbouring countries such as the net importing country of Chili and to the rest of the world.⁽⁷¹⁾

In 2010, Venezuela exported 1.7 billion barrels per day (bbl/d) and as such stood as the eighth-largest exporter in the world and the largest in the Western Hemisphere. In 2011, its oil production reached 100,000 bbl/d, (billion barrels per day) equalling that of 2009. However, oil production levels have decreased by one-quarter since 2001 because of aging fields, maintenance problems and shortfall in foreign investment.

Brazil is also set to become, thanks to the advances in technology, one of the major producers of oil. 500 miles off its southern coast lies the promising basin of Santos the reserves of which are located below a layer of salt about more than a mile thick and more than 4 kms beneath the sea bed⁽⁷²⁾. According to the president of the Agência Nacional de Petróleo, (ANP), the national agency for petroleum, the Santos Basin potential reserves account for 80 billion barrels of oil equivalent (boe). As a result, Brazil could become one of the major producers and exporters of oil in the world in the coming years.⁽⁷³⁾.

Conclusion

Currently, the world is not running out of oil in the face of the long-term sustained global demand. The future of world oil production

⁽⁷⁰⁾- “The Net Oil Giant?” **Economist**, March 19, 2009

⁽⁷¹⁾- Annen , Badot, Livrozet, Mounier, Mourion--Druol, Rene, Sader, **Géopolitique de l'énergie**, op-cit., p. 5

⁽⁷²⁾- Yergin, **The Quest**, op-cit., p 117

⁽⁷³⁾- “The Net Oil Giant?” **Economist**, March 19, 2009

will depend on a higher level of technology and innovation, substantial investments and exploration of territories presently inaccessible for the development of new resources. This is the big and expensive challenge to take on in order to meet the needs of a growing global demand for oil.

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