



# What is a Peak Oil and When is It Going to Happen?

*A scientific research in International Economics*

**Gia Mosashvili — author, MA candidate of Diplomacy and International Politics at Ivane Javakishvili Tbilisi State University**

**International Student Scientific Conference II held by Georgian National University**

**Tbilisi, Georgia**

**2019**

## Abstract

Peak oil is the point in time when crude oil production has reached its maximum rate after which it starts declining. Causes could be geological and economic factors. The term ‘oil’ has many definitions in English language but we use it as crude oil. ‘Peak’ means a bell shaped curve. The peak oil theory proves that when oil extraction reaches peak, price of crude oil grows and it will never fall. Also, the theory includes the notion that after this historical moment, oil will start declining forever. The developer of peak oil theory is Marion K. Hubbert, who predicted the future of American crude oil. He explains that the United States started oil producing from zero in the late 19th century, reached peak between 1965 –1975 and declined from 1976. He predicted that for 2150, oil production will be the same as it was in the 19th century – zero. Later, Hubbert’s notions expanded on other oil producing regions. There are proponents and opponents of peak oil theory, some agree and some disagree.

Scientific research ‘What is a peak oil and when is it going to happen?’ aims to check and examine peak oil theory, its validity and compliance with reality. The paper includes five parts: introduction, observation, findings, conclusion and bibliography. In findings, which is a major research, peak oil theory is rejected and the reason is its inaccuracy with recent statistics of oil prices and undiscovered oil resources. As for the methodology, quantitative and qualitative methods are used for analyzing primary and secondary documents.

**Key words:** peak oil, peak oil theory, crude oil, USA, Marion King Hubbert, USGS, OPEC, UN

## Introduction

Peak oil is the point in time, when the extraction of crude oil has reached its maximum rate, after which the decline of rate forever is expected. The cause could be geological factor or economic but most likely it will be the combination of two (Slate, 28 November 2019). According to the Business Insider, there are some beliefs about the concept of peak oil. Some think that peak oil refers to the point, when oil is run out in the world, which will result in a global economic crisis. Others believe that peak oil took place in the past, in the 1970s, in the United States and now the world is recovered from it. However, neither of these conceptions is accurate (Business Insider, 7 January 2010). In general, the term ‘oil’ has some ambiguity, while the term ‘peak’ does not. Oil refers to things such as ethanol, biodiesel, palm oil, bottled gas (propane and butane) and refinery process, as gaining oil. But now, we mean only crude oil and condensate (pentane), which is a product of natural gas wells. As for the term ‘peak’, some people say that peak demand and peak supply are different, but this is not true. It is not because supply and demand are a function of price. The reality is that more oil producers are willing to deliver higher oil prices and because of this, fewer consumers are willing to buy oil. So, peak demand and peak supply are depended on the price (Slate, 28 November 2019). Oil does not grow on trees. The first in understanding peak oil is the recognition that oil is a finite and non-renewable resource. Beside water, there is no other liquid that humans rely on more than petroleum, because it fuels our vehicles, heats our homes, paves our roads and is used for making countless consumer products. Peak means a bell shaped curve (Business Insider, 7 January 2010).

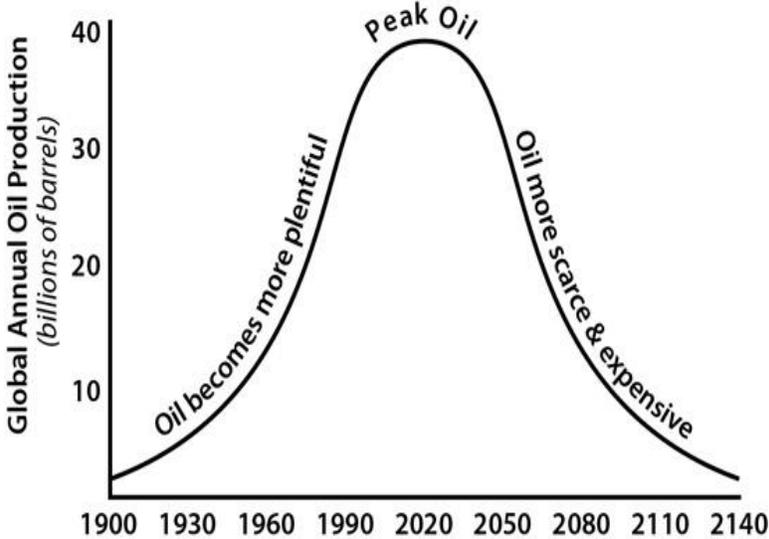
In the whole, between OPEC (Algeria, Angola, Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kuwait, Libya, Nigeria, Saudi Arabia, United Arab Emirates and Venezuela) and non-OPEC member countries (United States, Russia, Canada, China and Brazil), the United States is the biggest oil producer country, whose share is 16.2% in world oil production. Saudi Arabia is the second biggest oil producer country with the share of 13%. Russia is the third country and produces 12.1% of world’s crude oil. Canada is the fourth oil producer with the share of 5.5%. The next, fifth country is Iran with 5%. Iraq follows to Iran with 4.9% of oil production share and is the sixth oil producer country in the world. United Arab Emirates has 4.2% of share in oil production. China produces 4% of crude oil and is the 8th oil producer country. Kuwait follows to China with its 3.2% share of oil production. The last country is Brazil with 2.8% of oil production (Statista, 21 August 2019). According to the Organization of the Petroleum Exporting Countries, the share of OPEC in crude oil production is 79.4% (1,189.80 billion barrels) and as for the rest 20.6% (308.18 billion barrels) is produced by countries, which are not member of OPEC. At the end of 2018, from OPEC member countries, the biggest share of crude oil was extracted from Venezuela’s crude oil reserves – 302.81 billion barrels, which is 25.5% of the whole OPEC share. Saudi Arabia stands on the second place with its share of produced crude oil - 267.03 billion barrels. Iran, also member of the OPEC, is the third biggest country with its crude oil reserves – 155.60 billion barrels were extracted at the

end of the 2018 and 13.1% of the world crude oil reserves was here. The share of Iraqi crude oil reserves, in this year, was 12.2% - 145.02 billion barrels. Kuwait is the fifth country with, whose share of crude oil extraction was 8.5% - 101.50. United Arab Emirates is the sixth oil producer country with the share of 97.80 billion barrels – 8.2% of the world’s crude oil reserves. Libya stands on the seventh place with its share in crude oil extraction – 48.36 billion barrels (4.1%). As for Nigeria, it is the 8th OPEC member country, with 3.1% share of crude oil reserves – 36.97 billion barrels. Algeria’s share of crude oil reserves in 2018 was 1.0% - 12.20 billion barrels. Ecuador is the 10th oil producer country, with 0.7% (8.27 billion barrels) share of crude oil reserves. Angola is the 11th OPEC member country, with its share of crude oil reserves – 0.7% (8.16 billion barrels). Congo stands on the 12th place and in 2018 its share of crude oil reserves was 0.3%. Gabon stands on the 13th place with 0.2% (2.0 billion barrels) share of crude oil reserves. And the last country is Equatorial Guinea - 0.1% share of crude oil reserves – 1.10 billion barrels (OPEC, 30 November 2019).

## **Observation**

Peak oil theory includes the notion that in the early 21st century, conventional sources of crude oil either have already reached or are about to reach their maximum production capacity worldwide and by the middle of the century, it will diminish significantly in volume. Conventional oil sources, which are easily accessible deposits, are produced by traditional onshore and offshore wells. Via natural pressure, mechanical walking beam pumps or secondary measures such as injecting water or gas into the well in order to force oil to the surface, oil is removed from onshore and offshore wells. The peak oil theory does not apply to unconventional oil sources, which means any deposit of oil, which requires substantial investment and labour exploit (oil sands, oil shales, oil extracted after fracking tight rock formations and oil found in deepwater wells, which are far from offshore. There are proponents and opponents of peak oil theory. Instead of necessarily claiming that conventional oil sources will run out immediately and acute shortages will be created, which will result in global energy crisis, proponents of this theory suggest that with the production of easily extractable oil peaking and declining in formerly bounteous regions such as Saudi Arabia, crude oil prices will remain high and rise further over time, especially in the situation, when global oil demand continues growing parallel to the growth of emerging economies such as China and India. Peak oil theory includes the notion that days of inexpensive fuel (seen after the collapse of OPEC cartel prices in the mid-1980s) will never return (Encyclopedia Britannica, 22 November 2016). In the collapse of the OPEC, there is meant oil embargo imposed by the members of the Organization of Petroleum Exporting Countries (much of Western Europe, Japan and other nations), which agreed to stop exporting oil to the United States. Oil embargo lasted five months, until March 1974, but caused shocks throughout the industrialized world and showed our utter dependence on petroleum. Government leaders and academic institutions realized after these events that the global oil economy would not last forever (LiveScience, 12 February 2015).

The first developer of the peak oil theory was Marion King Hubbert, an American geoscientist, who was also a researcher of the Shell Oil Company. He studied geophysics at Stanford University and in other institutions. He firstly started talking about the declining of petroleum production in 1956, at a meeting of a branch of the American Petroleum Institute. Hubbert presented his paper in which he had depicted the production of petroleum by the United States, which started producing of oil from zero in the late 19th century, reached peak, between 1965 – 1975, from 2.5 billion to 3 billion barrels per year (approximately 6.8 million to 8.2 million barrels per day) and declining after its growth, from 1976. He predicted that for 2150, the production of oil will be the same as it was in the 19th century – zero. As for the declining in numbers, he assumes that in the whole, untapped reserves of oil is 1.25 trillion barrels and using of oil would reach a peak for about 2000 year, from which roughly 12 billion of barrels will be used per year (some 33 million barrels per day). After the quickly decline, oil will eventually disappear in the 22nd century. Accurately, Hubbert’s theory and his prediction turned out right after the oil-well production by the United States reached peak in 1970 at approximately 9.54 million barrels of crude oil per day, while only 6.4 million barrels were used per day in 2012. Hubbert’s notion about the global crude-oil production peak is very controversial topic between analysts. Some analysts argue that a peak was reached in the early 2000s. Others argue that Hubbert underestimated undiscovered oil reserves especially in Arctic, South America and Sub-Saharan Africa. They prove that extracting methods have improved productivity during the production process and enabled producers to get more oil out from declining wells. So, they counter that the world has not yet reached peak in oil production (Encyclopedia Britannica, 22 November 2016).



Source: Explainingthefuture.com, 30 November 2019.

According to the Energy Bulletin, Hubbert was right because his prediction turned out to be true. Argument for this is a historical fact about the United States oil production, which peaked between 1970 -1971, at 11,297,000 barrels a day. Hubbert's curve still stands - including the United States, 40 countries have reached peak in domestic oil production. It is true that oil producing regions do not fit the bell shaped curve exactly, because oil production is dependent on various geological, economic and political factors, but Hubbert curve remains a powerful predictive tool (Business Insider, 7 January 2010). Since Hubbert introduced the concept of peak oil, countless forecasters from the industrial, governmental and academic worlds, tried to agree or disagree with Hubbert's prediction. Geoscientist Kenneth Deffeyes, author of 'When Oil Peaked', asserted that peak oil happened on Thanksgiving Day 2005. Petroleum geologist Colin Campbell, who is also a founder of the Association for the Study of Peak Oil (ASPO), estimated that peak oil occurred around 2010, but his view was shifted after the new data became available. Alan Carroll, a geologist at the University of Wisconsin-Madison, and author of 'Geofuels: Energy and Earth', said that Hubbert got a lot of notoriety in his lifetime and correctly predicted that the U.S oil would reach peak in 1970. Carroll also points out that the same situation was extended to the rest of the world. There are many predictions that global oil production will reach a peak, but none is happened yet. The trouble is in determining – when the peak oil will occur, or if it has already been occurred. In determining process, prices of oil and oil reserves are very important. Reserves are amount of oil extracted from present-day prices and present-day technology. Peak oil is also depended on oil prices and available technology such as hydraulic fracturing, aka fracking and so on (LiveScience, 12 February 2015). Robert Blackwill and Jennifer Harris suggest in their book 'War by other means' that in the early 2000s, concerns about peak oil and new dependence on imported liquefied natural gas became evident. But today, the world is changed. During the past seven years, new energy sources were found around the world, including the waters in Australia, Brazil, Africa and the eastern Mediterranean (Israel and Cyprus) (Blackwill, R., D., Harris, J., M. 2016: 205).

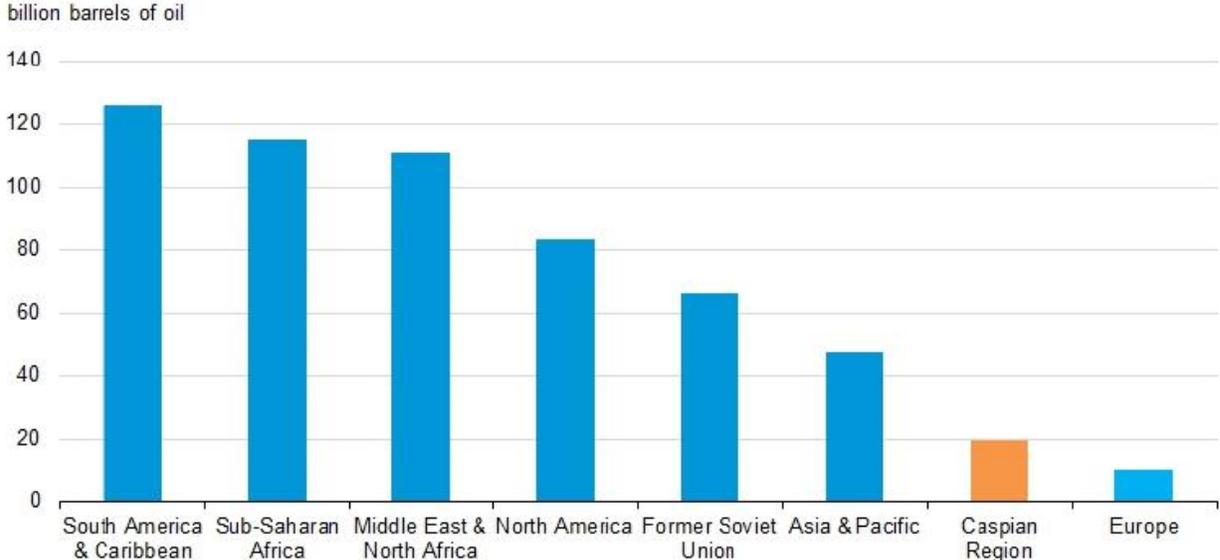
## **Findings**

Peak oil theory fails to accurately determine the exact date when oil peaked or when it is going to peak. Also, its notion about oil prices does not match historical oil prices. So, checking and examining of peak oil theory with primary and secondary documents is necessary.

In 2012, the United States Geological Survey (USGS) suggested the research, in which the stock of natural gas and oil resources in the whole world was calculated. The USGS claims that 65% of oil and 81% of natural gas are still undiscovered. According to their statistics, the biggest share of undiscovered oil is in the area of South America and Caribbean, where more than 120 billion barrels of undiscovered oil exist. The Second biggest share of undiscovered oil is under Sub-Saharan Africa, where they have estimated almost 120 billion barrels of undiscovered oil. The Middle East and North Africa stand on the third place with more than 110 billion barrels of undiscovered oil. North America is the fourth region with almost 90 billion barrels of undiscovered oil. As for the recent territories of post-Soviet countries (meaning all

Caspian Sea Area resources except Iran) more than 60 billion barrels of undiscovered oil can be found there. Asia and Pacific is the sixth region with its stock of undiscovered oil – almost 50 billion barrels. In the whole Caspian Sea region, 20 billion barrels of undiscovered oil is estimated. And the last region is Europe, in which USGS sees only 10 billion barrels of oil as undiscovered (U.S Energy Information Administration, 2013: 10). When Hubbert created peak oil theory, this statistics were not existed at that time. Subsequently, today’s reality is very different from Hubbert’s prediction.

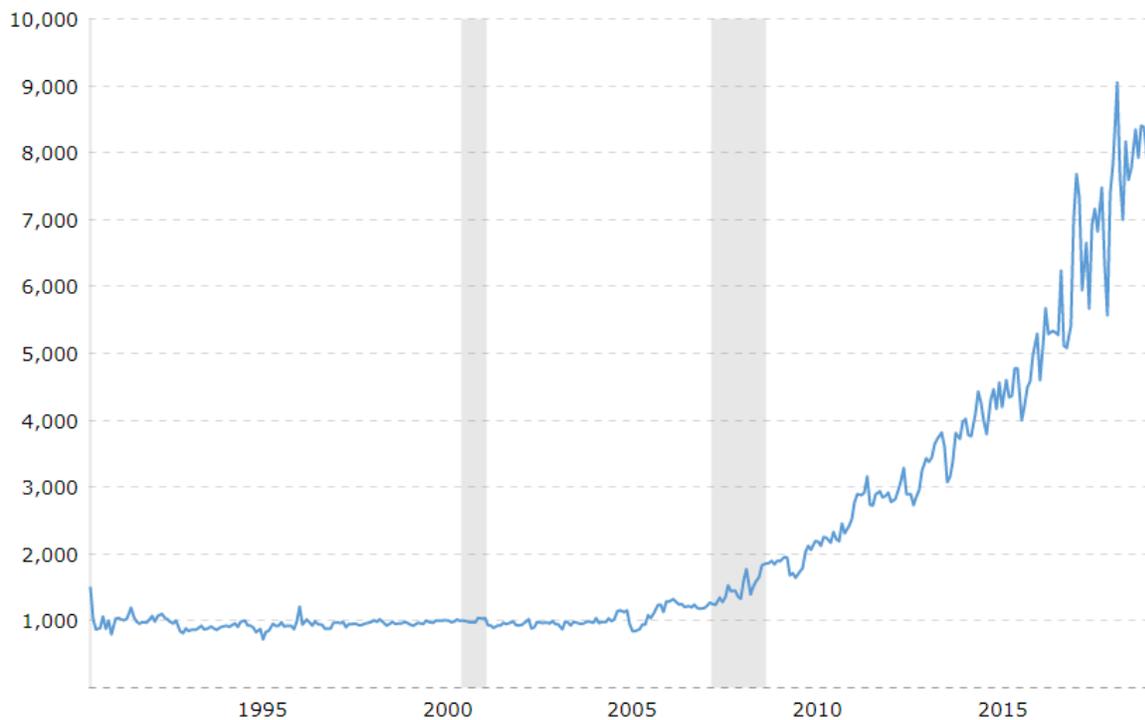
**World's estimated undiscovered oil resources, 2012**



Source: U.S Energy Information Administration, 2013. Pg: 10.

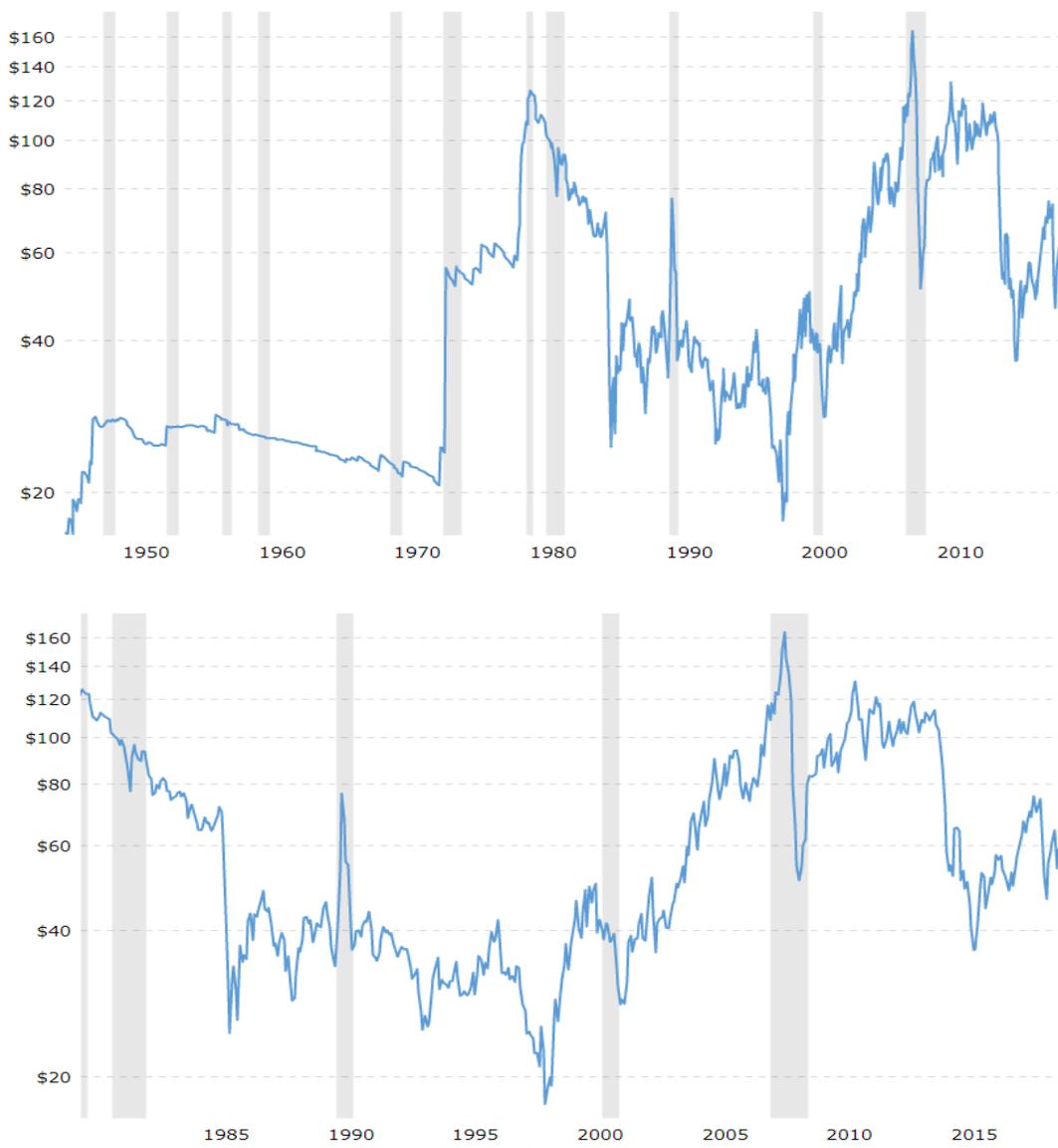
In peak oil theory, Hubbert suggests that the United States has already reached peak in oil production. Neither in 1965-1975, nor in 2000-2012, there was no any point, when oil reached peak in the United States. Moreover, statistics shows that everything goes contrary. The United States emerged as the leader of unconventional gas and oil production. In this transformation, oil fracking was the main driver. During the past two decades, energy innovators in North America modernized technologies and increased oil production. Renewed technologies included horizontal drilling of wells that penetrates bands of shale and hydraulic fracturing, when under high pressure fluid is injected into the rock to create fractures and release gas or oil, after the fluid is extracted. These new methods had an impact on global energy landscape. Developments in oil were potentially significant. Totally, crude oil production by the United States, which was 5.6 million barrels per day in 2010, became 9.4 million barrels in March 2015 – as high as daily oil production in Saudi Arabia. Dramatic increases in American Light Tight Oil (LTO) production were generated by fracking in the areas of Bakken (North Dakota), Eagle Ford (Texas) and Permian (Texas). Between 2008 and 2014, America experienced 56% growth in LTO production, which is larger than the total output of each of eight OPEC member states (totally, 12 states are in OPEC). Also, between this period overall oil production in the

United States increased by 77 percent. The USA surpassed Russia in 2013 and became new energy superpower. It will keep this position for many years (Blackwill, R., D., Harris, J., M. 2016: 205, 206). On November 15, 2016, officials said that the USGS discovered the largest continuous oil and gas deposit in the United States. The agency announced that the Wolfcamp shale, which is located in the Midland Basin of Texas' Permian Basin, contains 20 billion barrels of oil and 1.6 billion barrels of natural gas liquid. The Permian Basin is one of the most productive gas and oil areas in the whole country and in the Wolfcamp shale sections, more than 3,000 horizontal wells have been drilled. This discovery is nearly three times larger than oil found in 2013, in Bakken and Three Forks formations in the Williston Basin Province of Montana, North Dakota and South Dakota (USA Today, 17 November 2016). Subsequently, the notion of Hubbert about the peak oil in the United States is not valid. We can definitely say the same about the rest of the world. The best example is Iran. On November 10, 2019, in its southern part, Iran discovered a new oil field with over 50 billion barrels of crude. As president Hassan Rouhan said, the new oil source could boost the country's proven reserves by a third (Time, 10 November 2019). Statistics of the United States oil production and export is below.



Source: Macrotrends, 30 November 2019.

Peak oil theory also proves that prices of crude oil will grow, which will result in reducing the oil demand. In order to prove or disprove it, we should see prices of oil during the history, if they were growing or not. In 1987, average closing price of per barrel (159 liters US barrel) was \$19.20 (1 liter -0.12 cent). In 1995, average closing price of per barrel was 18.43\$ (1liter 0.11 cent). In 2000, average closing price of per barrel was \$30.38 (1 liter 0.19 cent). In 2005, average closing price of barrel was \$56.64 (1 liter 0.36 cent). In 2010, average closing price of per barrel was \$79.48 (1 liter 0.49 cent). In 2013, average closing price of per barrel was the highest - \$97.98 91 liter 0.62 cent). In 2015, average closing price of per barrel was \$48.72 (1 liter 0.30 cent). In 2019, average closing price of per barrel is \$56.81 (1 liter 0.35 cent) (Macrotrends, 30 November 2019). Statistics of oil prices are below.



Source: Macrotrends, 30 November 2019.

After the peak oil theory's inconsistency with real oil stocks and undiscovered oil resources, there is an inconsistency with estimated oil prices too. Despite of this, the fact that consumers of oil are reducing day by day – draws our attention. Today, international organizations promote green transport and implement special regulations over petrol driven cars, which results in reducing oil demand. For example, in 2015, leaders of 193 countries created plans called the Sustainable Development Goals (SDGs). From the United Nations 17 Sustainable Development Goals, 11th goal 'Make cities and human settlements inclusive, safe, resilient and sustainable' aims to replace petrol driven cars with hybrid and electric cars. According to the United Nations, for 2030, all of 17 Sustainable Development Goals will be achieved (United Nations, 2015: 3, 24). Beside this, with the 7th Sustainable Development Goal, the United Nations promotes renewable energy sources, including bioenergy, geothermal, hydropower, solar and wind. The Ministerial Declaration of the 2018 calls on governments and stakeholders to accelerate transition towards renewable energy, especially in end-use sectors such as transport, buildings, agriculture and industry. In Australia for example, the use of renewable energy continues rising and currently, around 16% of Australia's electricity is renewable. Progress is in Mexico too, which is making dynamic developments towards clean energy sources and 35% of energy here comes from clean sources. The largest producer and exporter of clean renewable electricity is Paraguay, which supports United Nations Sustainable Development Goals (United Nations, 2018: 3, 4, 5, 8). The consumption of oil is going to drop significantly, because transition to renewable energy becomes compulsory for UN member countries. Even oil prices will drop in global market. Subsequently, there is not the possibility of oil price growth in the future, predicted in peak oil theory.

## **Conclusion**

Peak oil theory includes interesting notions about when crude oil production reaches peak, but its validity is debatable. There are several discrepancies between the reality and future oil prices and oil reserves, which are predicted by the peak oil theory. Examination showed that theory needs to be renewed. When this theory was created, there were no considered neither the exact statistics of undiscovered oil resources, nor the United Nations Sustainable Development Goals, which currently promotes reducing of oil consumption and transition to renewable energy, because all of these events happened later. For more effectiveness and accuracy with recent situation, changes should be made in peak oil theory. If there are not made any changes, then this theory will lose proponents and become unpopular. Changes would improve its validity. As for the question, if crude oil production will ever reach peak, with recent undiscovered oil resources it seems that peak oil is not predictable in the near future. Moreover, if the United Nations Sustainable Development Goals will be 100% reached for 2030, we will never be able to predict.

## Bibliography

1) Blackwill, R. D., Harris, J. M. (2016). War by Other Means. Geoeconomics and Statecraft. Cambridge, Massachusetts, London, England. The Belknap Press of Harvard University Press. Pg: 205-219.

2) United Nations. (2015). Transforming Our World. The 2030 Agenda for Sustainable Development. United Nations. Pg: 3, 24.

<https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf>

3) United Nations. (2018). *Analysis of the voluntary national reviews relating to Sustainable Development Goal 7*. United Nations. Pg: 3, 4, 5, 8.

[https://sustainabledevelopment.un.org/content/documents/21159DESASDG7\\_VNR\\_Analysis\\_2018\\_final.pdf](https://sustainabledevelopment.un.org/content/documents/21159DESASDG7_VNR_Analysis_2018_final.pdf)

4) U.S Energy Information Administration. (2013). Caspian Sea Region. Overview of oil and natural gas in the Caspian Sea Region. Pg: 10.

<https://www.businessinsider.com/what-is-peak-oil-2009-12?op=1#hubberts-curve-still-stands-6>

<https://image.businessinsider.com/4b3ac6120000000000fc042f?width=500&format=jpeg&auto=webp>

<https://www.statista.com/statistics/282742/worldwide-oil-production-share-by-country/>

[https://www.opec.org/opec\\_web/en/data\\_graphs/330.htm](https://www.opec.org/opec_web/en/data_graphs/330.htm)

<https://www.livescience.com/38869-peak-oil.html>

<https://www.britannica.com/topic/peak-oil-theory>

[https://www.explainingthefuture.com/peak\\_oil.html](https://www.explainingthefuture.com/peak_oil.html)

<https://www.macrotrends.net/1369/crude-oil-price-history-chart>

<https://www.usatoday.com/story/money/nation-now/2016/11/17/usgs-largest-oil-deposit-ever-found-us-discovered-texas/94013292/>

<https://time.com/5723456/iran-new-oil-field-crude/>

<https://www.un.org/sustainabledevelopment/cities/>