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Professional paper

## REPUBLIC OF CROATIA IN GLOBAL OIL WORLD<sup>1</sup>

*Crude oil had a significant influence on the development of both global and Croatian economies. The dynamic growth of production, refining and consumption of crude oil, especially in the 1970s and 1980s was followed by and influenced the significantly higher growth rates of the gross domestic product than those occurred during the last years. Major oil companies were the leaders of the economic development on the global level, while at the local level such leaders are smaller national companies, such as INA Plc. and JANAF Plc. in Croatia.*

*Oil economy developed in turbulent conditions of crude oil market with constant oscillations of crude oil prices, through adjustments to the chal-*

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*lenges of implementing new energy policies and measures with regard to climate changes, political crises, and others. Over the last years, a stagnation in crude oil production and consumption has been observed on the global level (4,2 -4,3 billion tons), with a decline being recorded in the developed countries, while higher growth rates have been noticed in China, India and the emerging Asian economies.*

*The beginnings of crude oil (exploration and production) in Croatia dated back to the first half of the 19th century and the end of the 19th century and the beginning of the 20th century (refineries) respectively. The bloom of the Croatian oil economy during the 1970s and 1980s was marked by the crude oil production hitting a record high of 3,1 mil. tons (in 1981) in comparison with the present 613 thousand tons (in 2015) and refining of an all-time high amounting to 9,2 mil. tons (in 1979) as compared to the present 3,5 mil. tons.*

*Croatia contributes with 0,145 pro mille in the global oil production and with 0,862 pro mille in the global oil consumption. Further development and globalisation of oil sector may occur through intensifying the activities on crude oil exploration and production both in Croatia and abroad, but also along with the refineries modernization and increase of share on both domestic and foreign markets.*

*Crude oil transport followed the development of crude oil refining on the domestic market, and especially on the foreign markets of the countries of South-Eastern and Central Europe, with the highest transport of 9,7 mil. tons being achieved in 1990, as compared to 6,2 mil. tons in 2015, with the growth trend being observed owing to increase in transport for foreign refineries and their diversification of crude oil imports from the Omišalj direction. The diversification strategy directed towards storage of crude oil and petroleum products further supports the growth of oil companies and Croatian economy as well.*

*The Croatian oil economy will still remain under the influence of volatile oil market characterised by: price volatility, global trend of reducing the petroleum products consumption, stricter regulations and quality standards, policies and measures for enhancing the security of supply, growing costs and investments together with pressures of reducing prices, growth trend of imports and competitiveness of petroleum products, diversification of supply sources and routes and other. Therefore, continuous adjustments are necessary, as well as prompt responses to challenges and development of new strategies for diversification and growth.*

*Key words: crude oil, oil economy, Croatia, world*

## 1. Introduction

If something could characterise the period of the last 150 years, then it would be a swift development in all fields of human activities, starting from the aspects of transportation, quality of life, entire science, with the aim of achieving a greater quality of well-being and longer life.

IT technology, the Internet and social networks have turned the world into a truly “global village” – everything is accessible, we shop online via the internet, we have virtual friends, we make virtual partners, global economies need a decade to double BDP, while in the past it took centuries.

All that, almost dramatic development, all those activities could not even be imagined without the energy, which in an interaction with human genius develops, through the unstoppable process, the entire human knowledge dramatically increasing up to the unforeseeable proportions.

Such need for energy as a driver for innovation is precisely what dominates the geopolitics, politics, national economies, finances, unfortunately being also a partial cause of wars. Even today’s “earthquake” areas represent the important corridors for strategic energy sources (crude oil, gas).

While in the past “the competitive advantage lied in the availability of natural resources and production factors ratio”<sup>2</sup>, relating of course to a capital-to-labour ratio, today the technology is the one which is the development nucleus, yet the technology without energy cannot be imagined.

The 20<sup>th</sup> century is indeed a “century of oil”. Oil becomes the most significant energy crude and takes over the title of the “black gold” from coal. It signifies money and power, plays the key role in the industry, international trade, politics, scientific and professional development, it is the world’s blessing and at the same time the curse of human self-destruction as cause of numerous wars.

“The phenomenology of industrial development was created through the oil industry, from the domineering behaviour of the first oil “tycoons” to the organization of modern industrial corporation or establishment of the methodology of strategic analysis of business management”<sup>3</sup>.

The aim of this paper is to separately follow the global world and the Republic of Croatia, as regards the needs for energy, especially crude oil, aspirations of the great and the small to ensure the long-term resources and the energy availability, and the oil respectively, which is, let us say, a paradigmatic word when the energy is concerned, as driver of the development of humankind.

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<sup>2</sup> Thurow L. (1993).

<sup>3</sup> Dekanić I., Kolundžić S., Karasalihović D. (2002)

That global world that consumes all that energy or the global economy still generate an unequal distribution and ever-greater gap between the rich and the poor. “The global world is the most important media project. The global economy represents a modern Orwellian notion. On the surface, it implies the current trading “<sup>4</sup> (crude oil, gas, shares, gold, futures contracts, credits, interbank loans).“Beneath such glazed surface, the globalization of poverty is observed...“<sup>5</sup>. The Republic of Croatia keeps pace with the developed Western world, being the NATO and EU member, although there is a long path to achieve the prosperity of the developed countries.

## 2. Global oil world

### 2.1. History of oil forces

The oil industry is perhaps the most significant industry of the modern era. The oil itself, although known from ancient times (7000 years), experienced its real impact and full application during the 20<sup>th</sup> century. No other resource had such a huge influence on the human society, economy, military development, trade and relations between countries as oil did.

The oil industry as known today was created in the USA back in 1859. That year Colonel Drake found the crude oil in Titusville, Pennsylvania, at a depth of 23 meters, with the recovery of 20 bbl/d (barrels per day) marking the beginning of the modern oil industry development. Concurrently with the crude oil production, the first refineries were built, followed by the construction of oil pipelines. During those first decades of its development, the oil industry seemed to define its main activities: exploration and production, refining, transport and trading of the petroleum products. During that period the oil companies were also established that have persisted, in one way or another, until today.

In 1870 John D. Rockefeller founded the *Standard Oil Company* which was engaged in the crude oil transportation and refining. Being faced with great fluctuations in crude oil prices, he began to buy refineries and expand the business. Within approx. 10 years from its founding, his holding company controlled 90% of refineries and oil pipelines, owned the most of road and rail tanks, indirectly owned majority of the crude oil production, as well as the largest tanker fleet for

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<sup>4</sup> Pigler J. (2002)

<sup>5</sup> Pigler J. (2002)

the oil export in the world, in the situation when 85 % of the world's crude oil production and refining was located in the USA.

At the same time, the Nobel brothers as well as a part of the Rothschild family held the production in Russia, namely in Baku. A few years later, on that oil-rich field, in 1897 more precisely, the Samuel brothers founded *Shell*, which in 1907 would be merged with *Royal Dutch* into one company, and besides their interest in the Caucasus, they would produce the crude oil also on the Sumatra and Borneo. All that time, those two companies had the separate headquarters, listings on the stock exchange – one managed the production and refineries, while the other managed the storage and transportation. Finally, in 2005 they would grow into the global giant, completely integrated with single headquarters in London.

In another oil-rich area, in Persia, the influence and concessions were held by the *Anglo Indian Company*, founded in 1908 and changing its name into BP in 1954.

On the American soil, on 10 January 1901, Antun Lučić of Croatian nationality (took the US citizenship and changed his name into Anthony Lucas) found the crude oil at a depth of 380 m, in the Spindletop field, the first truly major oil field in Texas. It was the largest oil field in the US and back then also the largest in the world. It gave a new impulse to the development of the oil industry and started to create the first actual competition to Standard Oil. At that time, the following companies were also founded: Texaco (in 1902), Gulf Oil (in 1907), California Union Oil, afterwards Unocal.

Standard Oil itself, due to its dominant position on the market, as a monopoly, was subject to attack. Under the Sherman Antitrust Act of 1904, in 1911 the federal regional bureau in St. Louis decided to disintegrate the Standard Oil Company to more than 30 independent companies<sup>6</sup>. The extent of Standard Oil significance was shown through the future actors of the oil era, which have arisen from it: Exxon (Standard Oil of New Jersey), Mobil (Standard Oil of New York), Chevron (Standard Oil of California) and Amoco (Standard Oil of Indiana).

By the mid-20<sup>th</sup> century, the group of “seven sisters” (Exxon, Mobil, Shell, Chevron, BP, Gulf and Texaco) controlled 65% of the crude oil reserves, 88% of the crude oil production in the world outside the US and the Soviet Union, 77% of the refining capacities, two-thirds of the tanker capacities and all key oil pipelines<sup>7</sup>.

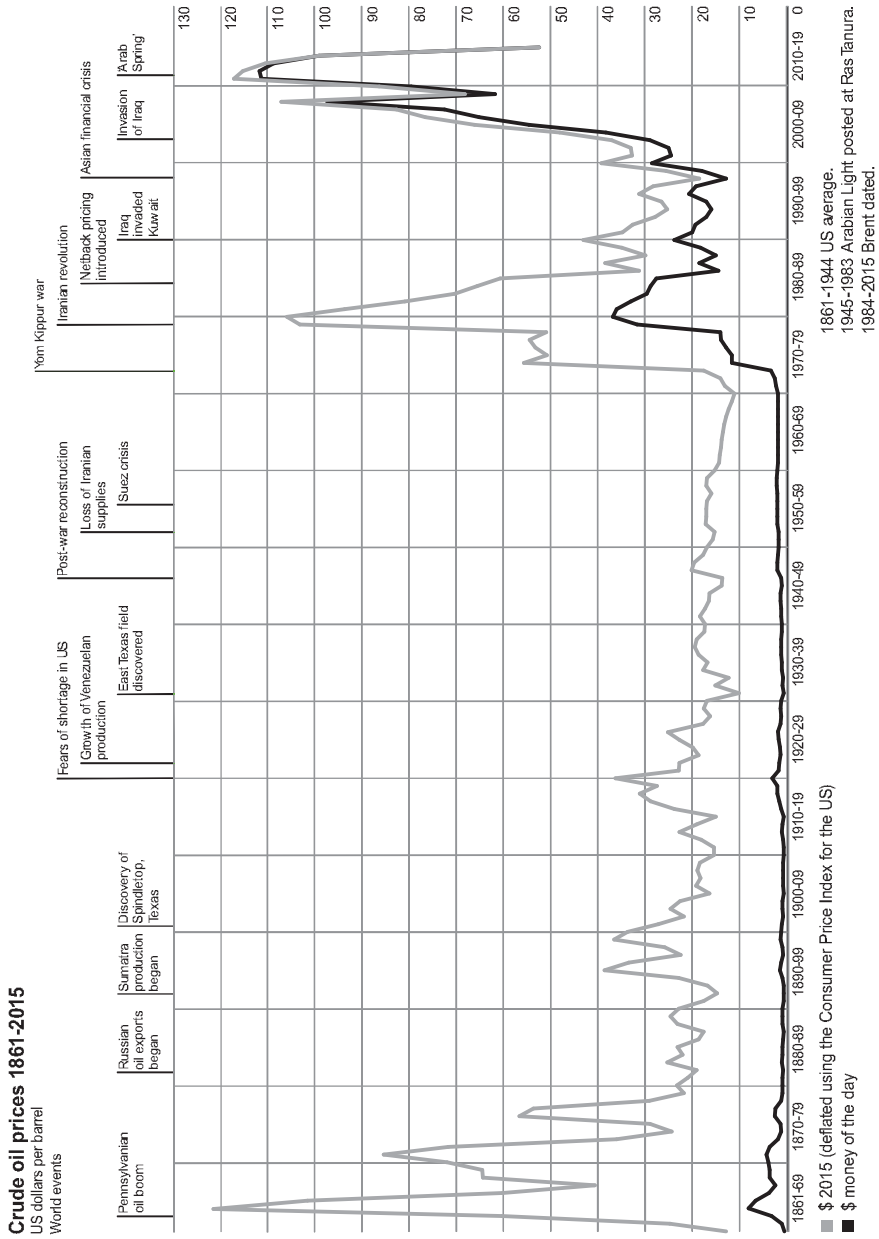
The oil industry developed the US and turned them into the world's force in the 20<sup>th</sup> century. Oil export caused the Arabian countries to prosper after 1973 and served as the means for transformation of Russian and the countries of the former Soviet Union.

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<sup>6</sup> Maugeri. L. (2006), page 18

<sup>7</sup> Dekanić I., Kolundžić S., Karasalihović D. (2009), page 380

Figure 1: SIGNIFICANT HISTORICAL EVENTS AND OIL PRICES (1861 – 2015)



Source: BP Statistical Review of World Energy, June 2016

Capital intensity, major capital investments required for the development of new production, high risk in all production phases from exploration to transportation routes, environmental restrictions, political risks – all of the mentioned influence the oil pricing<sup>8</sup>. The oil price itself varied significantly in the course of history, but it might be sufficient to mention a four-fold increase in the oil prices that occurred in 1973/1974, so-called first oil shock, then a two-fold increase during the second oil shock in 1979/1980, followed by the oil prices hitting an all-time low by end-1998 to which the oil companies responded by the greatest mergers and acquisitions in the history and the latest oil prices hitting an all-time high by mid-2008 (\$147) followed by the largest financial crisis since the 1930 great depression.

The crude oil as commodity plays the most significant role in the commodity trading (15 %), representing the greatest percentage of all commodities in total<sup>9</sup>.

## 2.2. Oil reserves

The size of the proved reserves changes over time. Thus, in the last 20 years, the proved reserves quantity was for 50,7 % higher compared to the end of 1995. It was mostly owned to the quantities discovered in the North Sea, Mexico, China and Alaska during the late 1970s. During the 1990s and 2000s, they were increased due to the discovery of new fields in the Caspian Region, Middle East, Brazil, Canada and Venezuela. It should be mentioned that, apart from the great discoveries, the oil prices, higher in average during the last 20 years, were actually the major factor influencing the increase in the proved reserves.

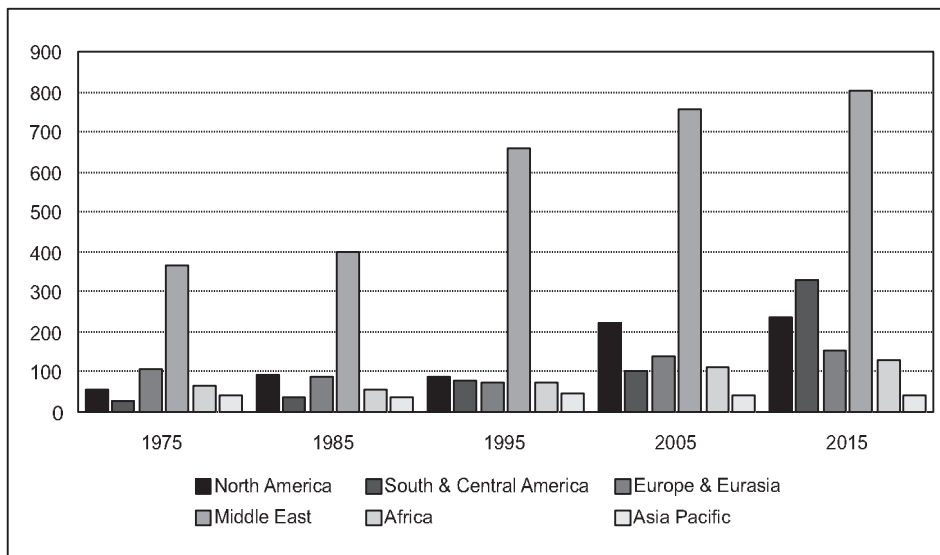
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<sup>8</sup> Seba Richard D. (2008). Five (5) major factors influence the oil pricing: market (oil supply/demand), reliability (production rate), location (transportation costs), quality (refining costs and yield) and availability (oil reserves), page 53

<sup>9</sup> EIA (2015)

Figure 2:

DISTRIBUTION OF THE PROVED RESERVES BY REGION  
 - 1975, 1985, 1995, 2005, 2015 (IN BILLION BARRELS)



Source: *BP Statistical Review of World Energy*, June 2016, and other years

The global proved oil reserves for the year 2015, according to the BP, are at the level of 232 billion tons and are sufficient for 50,7 years of the 2015 oil production<sup>10</sup>. It is interesting to know that in the last decade the proved oil reserves were raised by 24 %.

<sup>10</sup> *BP Statistical Review of World Energy (2016 and other years)*



Table 1:

## OIL RESERVES BY REGION, 1975-2015, IN BILLION BARRELS

in billion barrels	1975	1985	1995	2005	2015
<i>North America</i>	57,0	92,6	86,6	223,6	238,0
<i>South &amp; Central America</i>	25,9	34,9	78,9	103,6	329,2
<i>Europe &amp; Eurasia</i>	109,0	89,4	74,7	139,5	155,2
<i>Middle East</i>	368,3	398,0	659,5	755,6	803,5
<i>Africa</i>	65,1	56,7	73,1	111,3	129,1
<i>Asia Pacific</i>	41,4	37,3	44,1	40,8	42,6
<b>TOTAL</b>	666,7	708,9	1016,9	1374,4	1697,6

Source: *BP Statistical Review of World Energy*, June 2016, and other years

The world's largest reserves are found in the Middle Eastern countries (47,3 %), and the OPEC countries (71,4%). Europe, together with Eurasia, holds 9,1 % of the proved reserves, which is enough for the next 24,4 years of the 2015 oil production. The region of the South and Central America has the largest ratio of the oil reserves to production and it is so for 117 years<sup>11</sup>.

The largest oil fields are located in Saudi Arabia - Ghawar (1948), in Kuwait - Burgan (1938), Bolivar in Venezuela (discovered in 1917), Prudho Bay in Alaska, the USA, then Rumelia and Kirkuk in Iraq, etc. The largest on-shore oil field is located in the Persian Gulf (Saudi Arabia) and is named Safaniyah Hafiz, while the only European giant oil field is located in the Norwegian area of the North Sea, named Ekofisk, and is three times smaller in size than the one in the Persian Gulf<sup>12</sup>.

### 2.3. Oil production and consumption

The oil production and consumption are closely related to the development of the economy and human activity, with enormous historical influence on the geography, wars and global trade and mostly due to the reasons that the countries producers of oil are not at the same time its largest consumers.

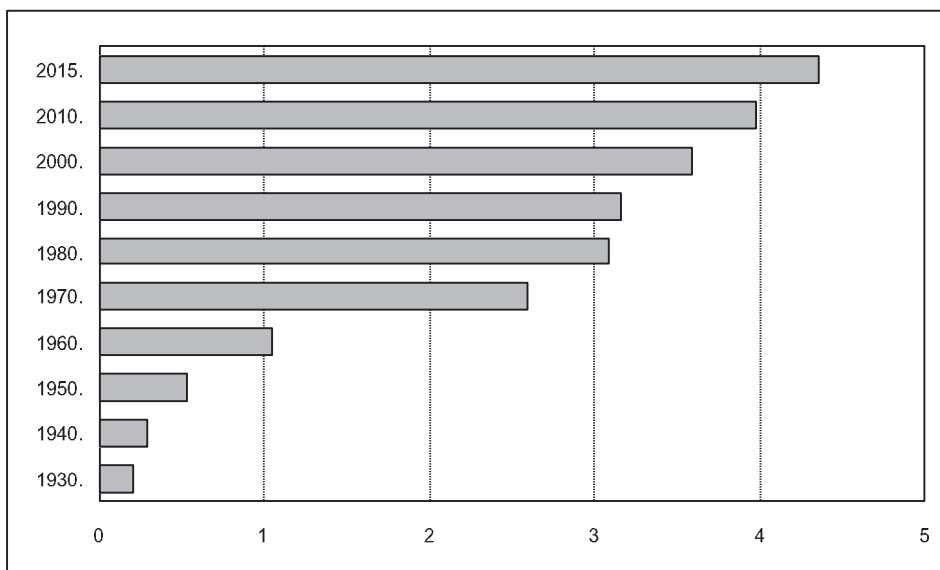
<sup>11</sup> *BP Statistical Review of World Energy (2016 and other years)*

<sup>12</sup> Juttner Preradović I. (2005)

Today, the global oil production is for 210 times higher than the oil production in the world before 100 years (in 1905, the production amounted to  $20 \cdot 10^6$  m<sup>3</sup>). The global economy growth followed the oil production growth and the two are closely interdependent. In the second half of the 20<sup>th</sup> century, the oil became the major energy source taking a 40 % share in the energy consumption<sup>13</sup>.

Figure 3:

TOTAL GLOBAL OIL PRODUCTION (IN BILLION TONS)



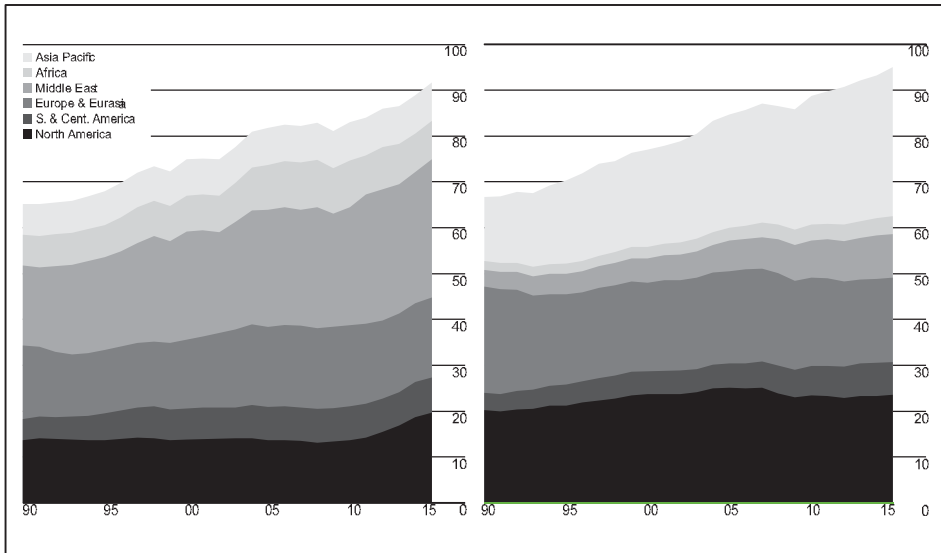
Source: Dekanić I., Kolundžić S., Karasalihović D. *Stoljeće nafte [A Century of Oil]*. Zagreb, Naklada Zadro and BP Statistical Review of World Energy, June 2016

The global oil production raised significantly during the last 20 years (by 33 %), from 3,28 billion tons in 1995 to 4,36 billion tons in 2015, mostly owing to the production growth in the US, Canada, Russia, Saudi Arabia and Brazil. The largest individual oil producers are Saudi Arabia (568,5 MT), the US (567,5 MT), Russia (540,7 MT), Canada (215,5 MT), China (214,6 MT), Iraq (197 MT), Iran (182,6 MT), the UAE (175,5 MT), Kuwait (149,1 MT) and Venezuela (135,2 MT).

<sup>13</sup> Dekanić I. *Nafta blagoslov ili prokletstvo [Oil as Blessing or Curse]* (2007)

Figure 4:

## OIL PRODUCTION AND CONSUMPTION BY REGION, 1990-2015



Source: *BP Statistical Review of World Energy*, June 2016

The global oil consumption in 2015 amounted to 4,3 billion tons of crude oil and marked the continuation of growth over the last several years (1,9% in 2015, 1% in 2014 and 1% in 2013). The economies of the developed countries of the North America, Europe and Asia have the greatest impact on the oil consumption, which has also been observed over approx. the last 10 years with the Chinese and Indian economies. Thus, the North America consumes 23,9%, while the US alone consumes 19,7 % of the total global consumption. Asia, without Russia and countries of the former Soviet Union, consumes 34,7 %.<sup>14</sup>

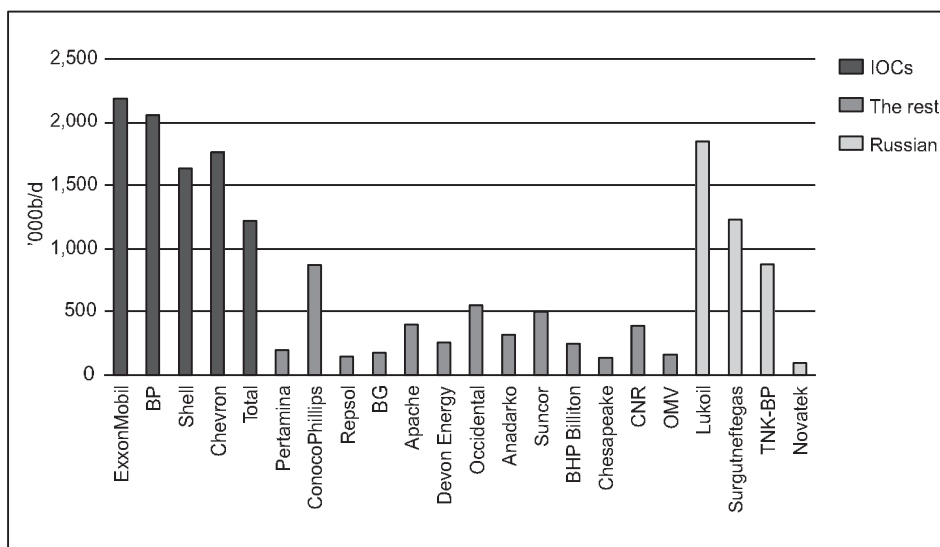
<sup>14</sup> *BP Statistical Review of World Energy*, June 2016

### 2.4. Major companies

Today, the oil sector is, by its numerosity and size, perhaps the world’s largest sector. Thus, the vertical companies that we all know (with several centuries long tradition) and listed on the world’s stock exchanges, even today dominate the global oil market with the intertwined interests of their originating countries. On the global oil market, American ExxonMobil and ChevronTexaco, British BP and British-Dutch Shell still have their influence. In Europe, besides the great “majors”, other large companies are also present like French-Belgian Total, Italian ENI, as well as Russian Lukoil, Gazprom and Rosneft. In this part of Europe, among the larger companies are also Austrian OMV, Hungarian MOL and Polish PKN Orlen. The world’s oil production in 2015, according to the OPEC, amounted to 95,1 million bbl/d. Figure 5 shows the production/output of the major international companies.

Figure 5:

OIL PRODUCTION OF THE MAJOR PRIVATE COMPANIES  
 (IN 000 BBL/D)

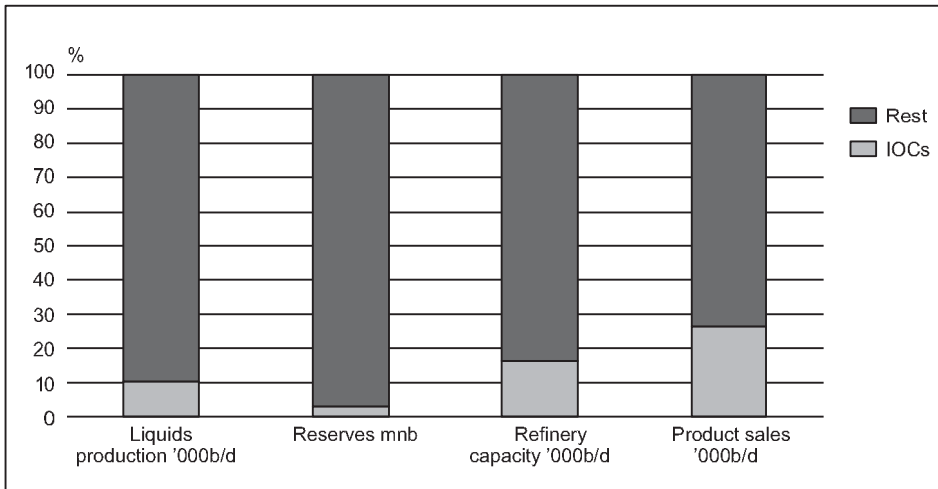


Source: Stevens P. (2016). *International Oil Companies*, Chatham House

The IEA (International Energy Agency with its registered seat in Paris) categorized the oil companies into the four basic groups given their ownership characteristics. Such categorization shall demonstrate better the current situation and help in better understanding of the future state of the companies and the oil industry itself. There are two basic categories – national and private companies. The national oil companies with the production on the domestic market, so-called “NOCs” (like Saudi Aramco, NIOC, Qatar Petroleum, Rosneft, Uzbekneftegaz, PDVSA, etc.; about 100 companies included) hold 64% of the global oil reserves, while the national companies with the production on both domestic and foreign markets, so-called “INOCs” (about 25 companies included, like Statoil, PetroChina, Sinocep, CNOOC, Petrobras, Petronas, etc.) hold 15 % of the global oil reserves. The private companies are divided into two categories – “Majors” (BP, ExxonMobil, ChevronTexaco, Shell, Total, ConocoPhillips and ENI) holding 7% of the global oil reserves; and “Independents” covering all the rest of the private companies (like Lukoil, Devon, Apache, Hess, Mitsubishi Corp., etc.) holding 13% of the global oil reserves<sup>15</sup>.

Figure 6:

PRIVATE INTERNATIONAL COMPANIES  
IN THE OIL SECTOR STRUCTURE, 2013 (IN %)



Source: Stevens P. (2016). *International Oil Companies*. Chatham House

<sup>15</sup> IEA. *World Energy Outlook 2013*. page 433, 434

The fundamental difference lies in the fact that the completely private companies are primarily turned to the needs and signals of the market, as well as to the interest of their shareholders. Looking at Figure 6, it can be observed that practically in all segments, they are well behind the state national companies and therefore the future picture is not so attractive and brings great challenges that the private companies will need to face in the future.

### 2.5. View to the future

Without energy, the modern civilization is unthinkable. Oil shall remain the largest energy source, fundamental for the development of the world's transportation and chemical industry. According to Exxon Mobil, the oil needs will be 20% higher in the year 2040 than today, with the possibility of the North America becoming the oil exporter already between 2020 and 2025<sup>16</sup>. Similar projections are also given by BP, according to which the oil demand shall be increased by 20% until 2035, but with the further decline of oil's share in the total energy consumption (from 32% to 29%)<sup>17</sup>.

The progress achieved in the technologies of oil and gas exploration and production made the hydrocarbon sources more accessible and larger, with the recoveries of the individual fields becoming more abundant<sup>18</sup>. Thus, according to CERA, the total annual decline in production from individual oil fields amount to 4,5% and is significantly lower than 8% as originally mentioned. The lower production decline and longer production life are the results of the increased investments, better planning and progress in technology (jet drilling, horizontal drilling, fracturing). The reservoir can often be kept alive longer than originally anticipated, while 63% of the remaining reserves is related to the fields which are still in the period of the production growth or the maximum production and account for 59% of the current production. Today, the recovery averages to about 45-50% compared to 33,3% in 1987 or 38,6% in 1996.

The increased oil production in 2035 is expected from Iraq, Brazil, Canada, Kazakhstan, the USA, Venezuela and Saudi Arabia.<sup>19</sup> Furthermore, the IEA expects the future growth of the global oil consumption at the level of 1 million bbl/d (mmbbl/d) annually, which would predominately occur in the transportation and

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<sup>16</sup> ExxonMobil 2016. *The Outlook for Energy: A view to 2040*

<sup>17</sup> BP Energy Outlook 2016 Edition, *Outlook to 2035*

<sup>18</sup> Dekanić I., Kolundžić S., Karasalihović D. (2002). page 386

<sup>19</sup> IEA: *World Energy Outlook 2013*. page 486

chemical sectors, owing mostly to Asia with its average growth of 2,3 % annually. As opposed to Asia, Europe and the US should decrease their oil consumption under the influence of the energy efficiency and the renewables, being more and more used.

### 3. Oil and oil economy of Croatia

#### 3.1. Oil beginnings<sup>20</sup>

On the territory of the Republic of Croatia, tars are known for centuries – natural petroleum outcrops, namely in Međimurje, around Kalnik, in Moslavina, Western Slavonia, on the Adriatic coast and islands. In ancient times, this thick, black and oily liquid was gathered at the sources and was used mostly for the therapeutic purposes or as grease. The natural oil source at Mikleuška was mentioned for the first time back in 1391 in the Donation Charter of a rich feudal family of Čupor in Moslavina. The family donated to the Pavlin monastery, beneath Garić, the land of Paklenica near the village of Paklenica. The name of that land, named after the tar, confirms that even then there were the oil wells. However, the first document on the oil production dates back to 1836 when it was written that in Peklenica, near Mursko Središće, the earth oil was obtained at the property of Count Juraj Festetić<sup>21</sup>. Besides Peklenica, the oil beginnings on the Croatian territory are related to the places of Selnica, Mikleuška, Bačindol, Ludbreg, Ribnjak and others.

By passing the Austrian General Mining Act on 23 May 1854, the legislative procedure of exploration and production was regulated, among others, of ores and earth pitches. Under the same Act, the Mining Authority in Zagreb issued the first “mining permit” for oil exploration in Peklenica (Međimurje) and Voloder - Mikleuška (Moslavina) on 1 August 1855.

From the first organized oil production on the Croatian area until today, many individuals and companies tried to get to the “black gold”. As concerns the owners of oil fields, the primacy needs to be given to Count Juraj Festetić, who in 1856 already paid his labourers to extract the oil. The first authorization for oil production was issued to Count Festetić on 19 November 1860. He was known in the history as the first owner of the oil fields in Međimurje under the Austrian General Mining Act.

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<sup>20</sup> Novak Zoroe Š. (2014)

<sup>21</sup> Žgaljić J. (2003)

As concerns the progress in oil exploration and production, it is important, among others, to point out that a German company of Petrol Plc. discovered in 1941, by using the method of deep drilling, in an Eastern part of Moslavina, the first major oil field in Croatia, known as Gojlo. From the wells deep around 700 meters, the quantity between 50 and 70 tons of crude oil was produced daily.

### ***3.2. Oil exploration and production in the last 70 years and perspectives***

The oil exploration and production in Croatia experienced its full momentum in the year 1952, by the establishment of a unique company of Naftaplin, with its registered seat in Zagreb<sup>22</sup>. That year, 102.000 tons of crude oil and around 6,5 million cubic meters of natural gas were produced in Croatia. In the period from 1952 to the present days, 45 oil fields and 30 gas fields respectively were equipped and put into operation in the *continental part of Croatia*. In total, 106 million tons of crude oil were produced, as well as about 9 million tons of condensates and 74 billion cubic metres of natural gas. About 4.500 exploration and development wells were constructed, as well as around 1.200 oil completion wells and around 200 gas completion wells. The highest annual production in Croatia was recorded in 1981 and amounted to 3.140.777 tons, while the most fruitful period was between the 1970s and the 1990s (Figure 7).

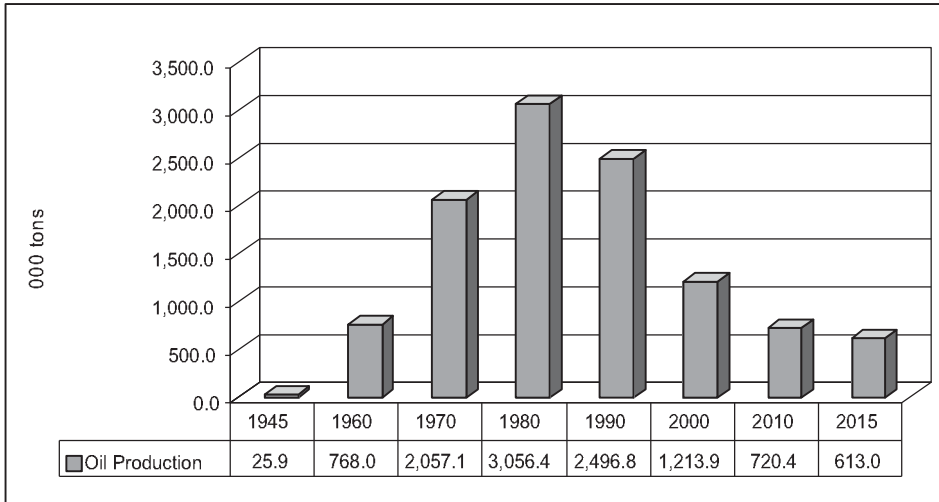
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<sup>22</sup> Novak Zoroe Š. (2013)



Figure 7:

## OIL PRODUCTION IN CROATIA (1945-2015)



Sources: Energy Institute Hrvoje Požar: *Energy in Croatia from 1945 to 2007 and Annual Report, Energy in Croatia, various years, INA Annual Report 2015 and other years*. INA-Oil Industry Zagreb

The oil production decline is accompanied by a significant decline in the hydrocarbon reserves from 304 million barrels in 2005 to merely 168 million barrels (approx. 23 million tons) in 2015.<sup>23</sup>

Since 2012, the activities have been performed on the EOR (Enhanced Oil Recovery) project in Ivanić-Grad, which, apart from enhancing the oil recovery in the fields, also has an environmental dimension given the fact that it will provide for underground injection of significant CO<sub>2</sub> quantities, thus decreasing its emission into the air. The production of additional 3,4 million tons of crude oil and around 500 million cubic meters of gas in total is planned to be achieved through the EOR project.

Besides, it needs to be mentioned that the highest natural gas production of 2.176.657.000 cubic meters was achieved in 1989. The largest shore-based oil fields are as follows: Beničanci, Stružec, Žutica, Šandrovac, Ivanić, Lipovljani, Jamarice, Đeletovci, Jagnjedovac, Bilogora. The largest shore-based gas fields are as follows: Molve, Bokšić, Kalinovac, Stari Gradac, Okoli.

<sup>23</sup> INA Annual Report (2015 and other years). INA – Oil Industry Zagreb

As concerns the *Adriatic offshore* area, the explorations started on 3 September 1970 by the leased French drilling platform “Neptun”, on the Jadran 1 well, opposite Dugi Otok. Upon procurement of the own platforms, Panon, Zagreb 1 and Labin (constructed in Croatian shipyards), the exploration activities in the Adriatic offshore expanded. By the exploration well named Jadran 6, in 1973 the first and the largest gas field, on the Croatian side of the Adriatic, was discovered and named Ivana (Northern Adriatic).

The four major world oil companies (Agip, Chevron, Texaco and Hispanoil) signed with INA-Naftaplin a joint exploration agreement of the Central and South Adriatic in Zagreb, on 4 March 1982. Under that agreement, nine wells in total were constructed on the islands of Mljet, Jabuka and Palagruža. Since no commercial quantities of crude oil were discovered, the further exploration was cancelled in 1987.

Furthermore, INA and the Italian company ENI concluded two Production Sharing Agreements related to the natural gas production in the areas of the Northern Adriatic (in 1996) and Aiza-Laura (in 1997). The partnership with ENI meant a significant diminishing of the financial risks and sharing the knowledge and technology. Since the production commencement in November 1999 until the end of 2015, over 17 billion cubic meters of gas were produced from 9 gas fields. In 2002, INA and another Italian company, Edison, concluded the Production Sharing Agreement in the contracted area of the Croatian Northern Offshore for the Izabela and Iris/Iva blocks.

The first activities of the Croatian oil companies abroad were in Albania in 1947, followed by the foreign works in Ethiopia in 1958, then in Egypt and in India in 1964. INA obtained its first foreign concession for hydrocarbon exploration in Jordan in 1968, together with two partners, Deminex and Nafta-gas. The concessions that followed were: in Cyprus in 1969, in Bangladesh in 1974, in Burma in 1975, in Gabon in 1977, in Vietnam in 1978, in North Korea and Indonesia in 1980. In that same year the activities expanded to Angola, which was “bingo” and in 1985 the first Croatian oil discovered on the foreign concession was delivered from that African country. From the production start until the present days, INA obtained from Angola over four million tons of crude oil. Then the exploration concessions followed in Tunisia, Turkey, Libya and Egypt. After Angola, the Croatian oil companies were successful in Egypt, where they work on several concessions. Since 1994, when the first oil production was obtained on the concessions in Egypt, until today, INA has produced more than 1,8 million tons of crude oil in total.

Syria is, undoubtedly, the greatest success of the Croatian geologists, since for the first time in the history of the foreign explorations that dated back to 1968 on the “non-perspective” Hayan block (as assessed by the respectable foreign companies), INA’s geologists explored on their own and discovered six fields. In 2004

and 2005, INA announced the commercial discovery on the fields of Jihar, Al Mahr and Palmyra. In August 2005, the oil production in Syria commenced. In 2011, the production of crude oil and condensates was realised in the amount of 6.799 barrels per day (bbl/d) and of gas in the amount of 13.463 bbl/d (in total, around 1 million tons of hydrocarbons). In the year 2012, the production of almost 25.000 bbl/d of hydrocarbons was expected. However, abiding by the Decision of the Croatian Government on implementing the international measures in relation to the Syrian Arab Republic, in February 2012, INA proclaimed the force majeure and temporarily suspended all business activities in Syria for an indefinite period.

Successfulness and development of the Croatian oil economy are tightly linked to the *organizational strengthening and expansion of INA* as an integrated company, from exploration and production of crude oil and gas to crude oil refining, petrochemical industry and trade (marketing), as well as to its globalization and expansion on the foreign markets respectively. By merging Naftaplin, Rijeka Oil Refinery and Sisak Oil Refinery, on 1 January 1964, the Oil and Gas Conglomerate (*Kombinat nafte i plina*) was founded and on 26 November of the same year, it is renamed into INA–Oil Industry (INA-Industrija nafte). The further integration of oil and petrochemical industry followed, which resulted in INA's becoming, during the mid-1980s, the highly integrated company composed of the organizations with INA prefix in their names: Naftaplin Zagreb, Rijeka Oil Refinery, Sisak Oil Refinery, Zagreb Oil Refinery, Nafta Lendava, Petrokemija Kutina (Fertilizer Plant), OKI, Omišalj Petrochemical Industry, Trade, Commerce, Produktovod, Development & Exploration, Project, Tours and others<sup>24</sup>.

In the period between 1980 and 1990, INA was the largest company in the former state. It employed 34.350 workers (1985)<sup>25</sup>, while its total revenue realized in 1990 accounted for ten percent of the entire economy of the Republic of Croatia. In 1988, the production of oil equivalent hit an all-time high in the INA's history, amounting to 5,14 million tons, of which 3,04 million tons of crude oil and 2,1 billion cubic meters of gas.<sup>26</sup>

Since the 1990s, the organizations and activities related to the petrochemical industry, transportation and storage of natural gas and others were separated from INA and the company has been gradually privatized since 2003. Its shareholders (2016) are: Hungarian oil company MOL (49,08%) and the Republic of Croatia (44,84%) and the institutional and private investors (6,08%). Today, INA is a «narrowed» company within the MOL Group since 2009 and consists only of segments of the activities related to the exploration and production of crude oil and

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<sup>24</sup> INA-Oil Industry Zagreb (1986). Zagreb

<sup>25</sup> INA-Oil Industry Zagreb (1986). Zagreb

<sup>26</sup> [www.ina.hr](http://www.ina.hr). About company, History

gas, refineries and marketing and retail. In 2015, the total hydrocarbon production amounted to only 40,9 thousand bbl/d (about 2 million tons) and there were 11.250 employees.

As regards the further development of *the onshore hydrocarbon exploration and production*, it involves the foreign companies and INA (on the existing and new concessions). The Exploration and Production Sharing Agreements were signed by and between the Croatian Government, the Canadian company Vermilion Energy and INA Plc. in June 2016, while such agreement is expected to be also signed with the Nigerian company Oando Plc.

Besides, in January 2015, the Government of the Republic of Croatia awarded ten licences for the hydrocarbon exploration and exploitation in the Adriatic to the consortium of Marathon Oil & OMV companies (withdrawn), the consortium of ENI & MEDOILGAS and INA Plc. companies.

Intensifying the exploration activities in Croatia (and for 5-7 years also of the production in case of positive discoveries) can contribute to the growth of the hydrocarbon reserves as a fundamental condition of the oil production growth (and gas) in the next decade. Thus, new possibilities will be opened up to further technical and technological development activities, further education advancement will be fostered and strong impact on the Croatian economic development will be given. Given the global character of the oil activity, further development is also possible by purchasing the concessions abroad, while the continuance of production in Syria is also expected.

### ***3.3. Beginnings of oil refining***

Today, the activities of oil refining are conducted by the oil refineries in Rijeka and Sisak.

#### *Rijeka Oil Refinery*

The Rijeka Oil Refinery started its operation in 1883, with an annual refining capacity of 60 thousand tons. For the next ten years, it was the largest oil refining plant in Europe. In the beginning, it was supplied by crude from the US, from Pennsylvania and since 1892 the crude oil for refining has come from the Baku area. After the First World War, the city of Rijeka became a part of the Kingdom of Italy, while the Refinery acquired a core role in the state programme of develop-

ing the Italian oil industry. Thus, it became the first industrial facility of the newly established oil company Agip.

In the period after the Second World War, the refinery accomplished the strong development through constructing numerous and more and more complex plants that responded to the challenges of the petroleum product market, especially fuels, as well as ever higher and “stricter” standards, greenhouse gas emissions, and requirements of profitable refining. What could be especially pointed out is the construction of Topping 3 at Urinj in 1976, which increased the primary refining capacity to 8 mil. tons. Afterwards, the oil refining of 5.580.078 tons hit an all-time high in 1979. Owing to the Rijeka lubricant plant at Mlaka, INA followed, in particular, the development of the car industry and put on the market new world class engine fuels, while the Zagreb Refinery continued successfully to develop the programme and production of all types of industrial and specialized lubricants, mineral oils and non-mineral liquids. The Rijeka Refinery capacities of a new age that were put into operation in 2011 were three processing facilities within the Hydrocracking complex: mild hydrocracking, hydrogen unit and desulphurization plant as well as numerous supporting facilities and installations.

The refinery’s further development is reckoned through the construction of the plants for heavy residual treatment and other facilities typical for the refinery complexity and the enhancement of the oil refining for the needs of the domestic and foreign markets.

### *Sisak Oil Refinery*

The Sisak Oil Refinery developed from a Shell storage facility built in 1923 on the spot where the Kupa Rivers joins the Sava River. In 1927, at the same location, Shell built a boiler distillation with a daily refining capacity of 170 tons. By refining the Rumanian crude oil, the refinery produced kerosene, gasoline, gas oil, fuel oil, lubricant oil and other products. The refining of domestic oil began in 1940. At the time, 96 thousand tons of oil was refined at the refinery, and the quantities increased continuously amounting to 638 thousand tons of oil in 1963 and to 1,556 million tons until 1970. From 1979, when the JANAF pipeline system became operational, the imported crude oil started to be refined.

During the 1970s and 1980s, the refinery achieved a strong development through construction of numerous plants that responded to the challenges of petroleum product markets, especially fuels, stricter standards as regards the greenhouse gas emissions, quality of products, but also to the requirements of the profitable refining. What could be especially highlighted is an increase in the refining

capacity to 6,7 million tons in 1980, making the Sisak Refinery the largest national oil refining plant at that time. That year the refinery achieved its own refining peak of 3,766 million tons of oil.

The development of the refinery's systems continues in the 2000s.<sup>27</sup> In 2007, the Desulphurization Plant (Claus) was put into operation, whose environmental impact was related to the maximum reduction in emissions of hydro sulphur and sulphur dioxide from the refinery fuel oil system. Furthermore, the hydrodesulphurization of FCC gasoline plant was put into operation in 2009 as well as the Isomerization Plant in 2011.

From mid-2013 the refinery has a possibility of production of diesel fuels with bio component. Since then the refinery has been refining only the domestic crude oil with a significant reduction in the refining quantities, while the plans for its further necessary modernization are not known.

### ***3.4. Oil refining and petroleum product consumption in the last 70 years and perspectives***

The activity of oil refining in Croatia (in Sisak and Rijeka refineries) developed through the past decades in accordance with trends and dynamics of petroleum products consumption and competitive advantages of the domestic refineries on the domestic and foreign markets (Figure 8).

The strong growth of petroleum products consumption in the 1970s and 1980s influenced the construction of the refinery capacities and the oil refining growth as well as the sale of the petroleum products on the domestic and foreign markets. In that period the share of the oil consumption in the total domestic consumption of the primary energy raised from 15,1% in 1970 to 50,2% in 1980, while in 1990 it was 46,3%. The decline of oil's share was particularly pronounced from the 2000s and in 2014 it fell down to only 31,3%<sup>28</sup> as a result of the decline in the economic activities, especially industry, significant decrease in the fuel oil usage in thermal power plants, then implementation of policies and measures related to the climate changes and reduction of the greenhouse gas emissions, enhancement of the energy efficiency and especially of an increase in the renewable energy share to 36,2% (water power, wood and biomass, other renewables). Such trend of the products consumption, and, in particular, the loss of certain foreign markets and market shares definitely had an impact on the oil refining downfall to about 3,5 mil. tons in 2015.

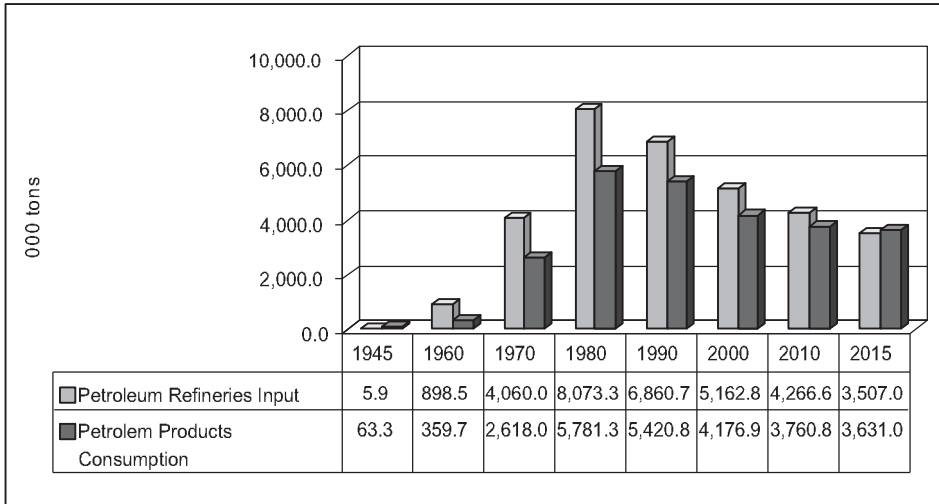
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<sup>27</sup> [www.ina.hr](http://www.ina.hr). About company, History

<sup>28</sup> Energy Institute Hrvoje Požar (2014 and other years). Zagreb, 2015.

Figure 8:

## OIL CONSUMPTION AND REFINING IN CROATIA (1945-2015)



Sources: Energy Institute Hrvoje Požar: *Energy in Croatia 1945 – 2007*, Zagreb, 2009, *Annual Energy Report*, *Energy in Croatia*, various years, *Study: Crude oil and petroleum product market of the users of the JANAF transportation system with estimates of crude oil transport until 2035* (under preparation)

The refining activity is related also to the retail business with a network of 822 filling stations, of which 381 are owned by INA, while the remaining 441 are held by the oil trading companies, Crodux, Lukoil, Petrol, Tifon and other.

The oil refining activity, as well as the entire oil economy, shall develop further along with numerous challenges (oil price volatility, stagnation/decline of petroleum product consumption, measures and policies related to the climate changes, processes of enhancing the refineries complexity and the integration with the petrochemical industry together with retail expansion, growing competition, political risks and others). Therefore, it is necessary to raise the refineries competitiveness and market shares and to realize the market expansions, together with investing into the deeper refining plants and increasing the refining quantities, as well as taking advantage of the domestic crude oil availability, possibilities of crude oil supply from several directions, especially from the Mediterranean, and others.

### ***3.5. Transport of crude oil and storage of crude oil and petroleum products***

The activities of crude oil transport and storage of crude oil and petroleum products make a strategically important part of the Croatian oil economy.

The formation and development of Jadranski naftovod (JANAF) are closely related to the development of oil consumption and refining on the territory of the South-Eastern (former Yugoslavia) and Central European countries. It was designed and built for crude oil transport from the Omišalj direction in the 1974-1979 period as a modern, efficacious and cost-efficient system of crude oil transport. The transportation started by the end of 1979. It was built with the designed capacity of 34 million tons of crude oil transport annually (mta) for the needs of the refineries in the former Yugoslavia (24 mta) and the users in Hungary and ex-Czechoslovakia (10 mta) that withdrew from the further partnership by paying the withdrawal fees.<sup>29</sup>

Since 1979 the pipeline has been continuously upgraded and modernized. Moreover, since 1989 on the Gola-Sisak section the crude oil can be transported even in a reversible direction, i.e. from the Hungarian/Druzhba oil pipeline direction. Besides, the Slobodnica-Donja Vrba oil pipeline section was also built and thus since 1999 the entire oil transportation has been running through the Croatian territory. The crude oil has not been transported by the JANAF pipeline for the Lendava Refinery since 2001 and for the Sisak Oil Refinery since 2013.

In 1995 the Omišalj-Urinj subsea oil pipeline was constructed for the supply of the INA Rijeka Refinery. The construction of a subsea oil pipeline linking the Krk Island to the mainland is under way (2016) that will replace the existing transport through the Krk bridge, and, at the same time, enhance the security of transport and consumer supply as well as the environmental protection. With the same purpose, continuous technical and technological as well as organizational and management modernizations of the oil pipeline and storage system are conducted, together with its adjustment to the users' requirements, standards related to the environmental protection, energy efficiency, safety and security.

From 27 July 1993, JANAF operates as a public limited company, predominately state-owned. The majority shareholders of JANAF Plc. (2016) are the state institutions (78,50%), a part of the shares is held by INA Plc. (10,80%) and HEP (5,35%), while the rest are held by the minority shareholders. The JANAF company is the operator and owner of the oil pipeline and storage system.

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<sup>29</sup> Kontent. J. (1986)

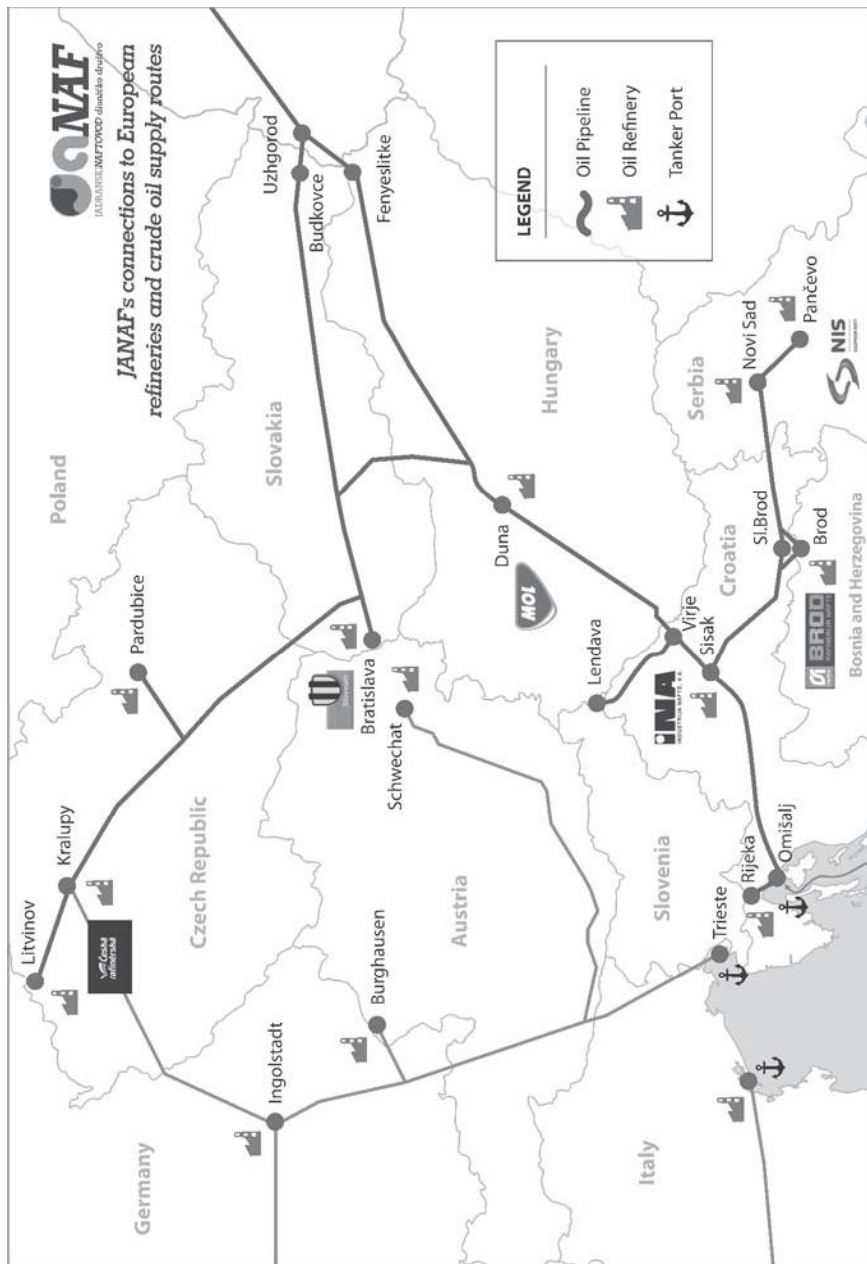


Today, the crude oil is transported by JANAF to: the national INA-Rijeka Oil Refinery and to the foreign users, namely the Brod Oil Refinery in Bosnia and Herzegovina, NIS refineries in Serbia, MOL refineries in Hungary and Slovakia (transport has been resumed since 2013), while the crude oil transport is also planned for the Czech refineries.

Thus, over the past years, the refineries for the Central European countries, which were JANAF's strategic partners back from the 1970s, have resumed to be supplied by the JANAF route, as result of the EU energy policy and the challenges facing the refineries in turbulent times for the oil market (Figure 9).

JANAF is recognized as strategic oil pipeline for enhancing the security of supply of the Central-Eastern European countries through the EU project of common interest named *the JANAF-Adria pipelines* and represents a part of the EU Adriatic-Baltic energy corridor. There is no doubt that "today more than yesterday" JANAF is of strategic interest for crude oil supply not only of Croatia but also of the countries of the South-Eastern and Central Europe since it provides them with a diversification of routes and sources of crude oil supply, namely from the Omišalj direction.

Figure 9: JANAF'S CONNECTIONS TO EUROPEAN REFINERIES AND CRUDE OIL SUPPLY ROUTES



Source: Workshop: JANAF Increasing Role in European Security of Crude Oil Supply by 2030. JANAF Plc., Zagreb, 24 March 2015

In the period from 1979 to the end of September 2016, around 212 mil. tons of crude oil were transported, of which 60% for foreign users, thus indicating a predominately international character of the oil pipeline. The highest average annual crude oil transport of 7,9 million tons was achieved in the period from 1986 to 1991, while the highest transport of 9,658 million tons was achieved in 1990. During the last years, the crude oil transport amounts to around 6-7 mil. tons.

Business risks, yet also the opportunities and strengths of further development, in conditions of volatile oil market, represented the challenges for the JANAF company, that deeply diversified its business operations by developing the activities of crude oil and petroleum products storage both for the needs of forming and keeping the compulsory stocks in accordance with the EU and national legislation and for the needs of the oil companies which protect themselves, by means of storage, from the oil price oscillations. Precisely for that purpose, over the past few years, 640.000 m<sup>3</sup> of the crude oil storing capacities have been constructed and 100.000 m<sup>3</sup> for petroleum product storage so that the total storage capacities at the Omišalj, Sisak and Virje Terminals amount to 1,54 mil. m<sup>3</sup> for crude oil storage and to 202.000 m<sup>3</sup> for petroleum product storage at the terminals of Omišalj and Žitnjak, Zagreb (purchased in 2009). For the market needs and purposes of the supply security the construction is under way, as well as the preparatory activities related to the construction of new storage tanks for crude oil and petroleum products and the facilities for enhancing the efficiency of operations and activities at the Omišalj Terminal, leading to potential branding of Omišalj as an Adriatic Centre for storage of crude oil and petroleum products and opening of new development opportunities.

#### 4. Conclusion

In this almost dramatical story on oil, global circumstances, repercussions of these circumstances on the Republic of Croatia, its impact on the geopolitical trends, national and global economies, development of humankind, there is an invisible thread – a thread on a man's aspiration to control the nature, development and his inexhaustible and unstoppable aspirations for progress. However, throughout the history, the oil was his ally to the greatest extent and the image of our near future is almost unimaginable without its deep impact on our lives and everyday living.

The oil industry, as known today, was created in the USA back in 1859 and represents the most significant industry of the last 150 years with a crucial influence on the human society, trade, economy and development of mankind. From

the Standard Oil founding, rule of the Seven Sisters, the OPEC countries cartel to the major national companies, development of the oil economy and its segments of exploration and production, the oil refining, transport and trade, the oil industry has a crucial influence, both in geopolitical and political sense, to the trends in the global economy. With the oil prices as the most important factor of the oil industry, the global economies fell into crisis, struggled with inflation or deflation, while the oil companies went through the periods of an incredible growth at a time of prosperity and the greatest mergers at the time of crisis.

The highest proved oil reserves continually increase and are found in the countries of the Middle East (47,3%), and in the OPEC countries (71,4%) respectively. The countries with the highest ratio between the oil reserves and production are the Southern and Central American countries (117 years). Today, the oil production is for 210 times higher than the oil production in the world before 100 years. The global oil production, as well as its consumption, rise significantly, mostly owing to the production in Saudi Arabia, the USA, Russia, Canada, Iraq, Iran and other countries. Owing to the Western world countries together with the growing economies of China and India, the world's oil consumption today is the highest ever (4,3 billion tons), and with its 40% account has the highest share in the energy consumption. Without oil, the modern civilization is unthinkable, and if judged by the most eminent sources, it will remain so at least for 20 – 30 years. Moreover, according to the sources of BP, ExxonMobil, IEA, EIA, the oil consumption will be approx. by 20 % higher in the next period (2035 - 2040) as it is at present. The technological development and progress, better planning and higher investments will enable the production growth, while the world's progress and growth of the economies will have a direct impact on the higher energy demands in the future.

The development of oil activities (exploration and production) on the Croatian territory started back in the thirties of the 19<sup>th</sup> century when they also started on the territories of the US and the Caspian region while the Rijeka and Sisak refineries, built in 1883 and 1927 respectively, were the backbones of the oil industry in the states back then. However, the 1970s and the 1980s were the flourishing periods for the Croatian oil economy. The oil production hit an all-time high amounting to 3,141 mil. tons (1981) compared to the present 613 thousand tons (2015). The refining hit its all-time high amounting to 9,234 mil. tons (1979) compared to the present 3,532 mil. tons. The reduction in the oil production was a result of drastically reduced explorations and reserves, while the oil refining decline was mainly a result of the consumption decrease on the domestic market and loss of shares and competitiveness on the domestic and foreign markets, due to an insufficient modernization of refineries and marketing. Nowadays (2015), Croatia contributes with 0,145 pro mille in the global crude oil production and with 0,862 pro mille in

the global crude oil consumption. An unfavourable trend and further globalization of the oil sector can be stopped by intensifying the oil exploration and production both in Croatia and abroad, but also through the refineries modernization and the share increase on domestic and foreign markets.

The oil transport reached its peak at the beginning of the 1990s and a record high transport amounted to 9,657 mil. tons (in 1990), as compared to 6,210 mil. tons in 2015, with the growth trend being observed owing to increase in transport for foreign refineries and their diversification of crude oil imports from the Omišalj direction. The diversification directed towards storage of crude oil and petroleum products opens up the opportunities for further development and growth of oil companies and the Croatian economy as well.

The Croatian oil economy will still remain under the influence of volatile oil market characterised by: price volatility, global trend of reducing the petroleum products consumption, stricter regulations and quality standards, policies and measures for enhancing the security of supply, growing costs and investments together with pressures of reducing prices, growth trend of imports and competitiveness of petroleum products, diversification of supply sources and routes and other. Therefore, continuous adjustments are necessary, as well as prompt responses to challenges and development of new strategies for diversification and growth.

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## REPUBLIKA HRVATSKA U GLOBALNOM SVIJETU NAFTE

## Sažetak

Nafta je imala značajni utjecaj na razvoj svjetskog pa tako i hrvatskog gospodarstva. Dinamičan rast proizvodnje, prerade i potrošnje nafte, posebno 1970. tih i 1980. tih godina bio je praćen i utjecao je na znatno veće stope rasta bruto domaćeg proizvoda nego su one posljednjih godina. Velike nafte kompanije bile su nositelji gospodarskog razvoja na svjetskoj razini, a na lokalnoj razini to su manje nacionalne kompanije, kao što su INA d.d. i JANAF d.d. u Hrvatskoj.

Naftno gospodarstvo razvijalo se u turbulentnim uvjetima naftnog tržišta uz stalne oscilacije cijena nafte, prilagođavajući se izazovima provedbe novih energetske politike i mjera u vezi klimatskih promjena, političkim krizama, i dr. Posljednjih godina proizvodnja i potrošnja nafte stagniraju na svjetskoj razini (4,2 -4,3 milijarde tona), pri čemu se u razvijenim državama bilježi pad, a veće stope rasta u Kini, Indiji i rastućim ekonomijama Azije.

Počeci nafte (istraživanje i proizvodnja) u Hrvatskoj bili su u prvoj polovici 19. stoljeća, odnosno krajem 19. i početkom 20. stoljeća (rafinerije). Procvat naftnog gospodarstva Hrvatske u 1970. tim i 1980. tim godinama obilježili su rekordna proizvodnja nafte od 3,1 mil. tona (1981.) prema današnjih 613 tisuća tona (2015.) i rekordna prerada od 9,2 mil. tona (1979.) prema današnjih 3,5 mil. tona.

Hrvatska sudjeluje s 0,145 promila u svjetskoj proizvodnji nafte i s 0,862 promila u svjetskoj potrošnji nafte. Daljnji razvoj i globalizacija naftnog sektora može se desiti intenziviranjem istraživanja i proizvodnje nafte kako u Hrvatskoj tako i u inozemstvu, ali i uz modernizaciju rafinerija i povećanje udjela na domaćem i inozemnim tržištima.

Transport nafte pratio je razvoj prerade nafte na domaćem tržištu, ali posebno na inozemnim tržištima država jugoistočne i srednje Europe, pa je tako najveći transport od 9,7 mil. tona ostvaren u 1990. prema 6,2 mil. tona u 2015. s trendom rasta zbog povećanja transporta za inozemne rafinerije i njihove diverzifikacije uvoza nafte iz pravca Omišlja. Strategija diverzifikacije prema skladištenju nafte i naftnih derivata podržava i dalje rast kako naftnih kompanija tako i hrvatske ekonomije.

Naftno gospodarstvo Hrvatske biti će i dalje pod utjecajem promjenjivog naftnog tržišta kojeg obilježava: promjenjivost cijena, globalni trend smanjenja potrošnje derivata, stroža regulativa i standardi kvalitete, politika i mjere za povećanjem sigurnosti opskrbe, rast troškova i investicija uz pritisku smanjenja cijena, trend rasta uvoza i konkurentnosti derivata, diverzifikacija izvora i pravaca opskrbe, i dr. Zbog toga su nužne kontinuirane prilagodbe, brzi odgovori na izazove i razvoj novih strategija diverzifikacije i rasta.

Ključne riječi: nafta, naftno gospodarstvo, Hrvatska, svijet