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Strategic Role of Oil Pipelines in EU Energy Supply

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SUMMARY

The oil pipelines have a strategic importance in the energy supply of the European Union (EU), especially given the fact that in the next two decades the crude oil will continue to be a dominant energy source, accounting for approx. 30% of the primary energy consumption, along with a reduction in the petroleum product consumption and growth in renewables.

Europe has a widespread network of oil pipelines of approx. 22,5 thousand kilometres (without Russia), connecting refineries to import oil ports or to land–based crude oil sources. The refineries of the Central Eastern Europe are supplied mainly from the Druzhba oil pipeline. Recently, these refineries have diversified their crude oil supply routes and sources, by sea imports from the North Sea, the Middle East, Canada and others (Poland) or by the TAL — IKL oil pipelines (Czech Republic) and the JANAF oil pipeline (Hungary, Slovakia and the Czech Republic). Given the insufficient diversification of crude oil supply precisely of the Central Eastern European region, particularly the landlocked countries (and refineries respectively), the EU has envisaged, among the projects of common interests, also six connection oil pipelines with terminals. At the same time, they are the only pipelines planned to be constructed in Europe and financed by the oil companies' funds.

The oil pipeline companies hastily modify their strategies by expanding business and becoming more and more transport–storage–energy oriented, and by investing in the flow reversal of oil pipelines and connection pipelines, storage capacities, as well as in enhancement of efficiency and flexibility of oil pipeline and storage infrastructures.

KEYWORDS

EU energy strategy, security of supply, oil pipelines, JANAF

INTRODUCTION

Our times are characterised by great changes. We are witnessing numerous predictions related to the energy and the energy strategies of the Republic of Croatia, the EU and the worldwide, asking ourselves a reasonable question is this to be a century of abandoning oil?

In the 20th century, oil ceased to be just a "black sludge" and becomes the paradigm of our times, inseparable from politics, economics, geopolitics and similar. An aspiration to rule over oil–rich sources and corridors becomes a fundamental geopolitical and economic force of the modern age.

Today, the oil is still strongly present, with high share in the energy consumption, and along with the powerful multinational giants Exon Mobile, BP, Chevron, Gazprom, Rosneft, ENI, Total, Shell, as significant pillars of the economy. But, "renewable energy is the fastest growing source of energy, contributing half of the growth in global energy supplies and becoming the largest source of power by 2040" [1].

The Republic of Croatia is a part of that global world and has an exceptionally important geostrategic position as Mediterranean and transit country, especially for the oil supply of the countries of South–Eastern and Central Europe.

As part of the European oil pipeline network, JANAF and the Republic of Croatia are an important part of the EU energy policy.

OIL IN ENERGY STRATEGY OF THE EU AND REPUBLIC OF CROATIA TO 2030

Strategic objectives

European Union

An important guideline of energy policies and trends in the energy consumption refers to the issue of climate changes and successfulness of implementation of international agreements, especially the *Agreement to voluntarily limit the greenhouse gas emissions*, signed in Paris in December 2015 (the Paris Agreement) during so–called *Conference of the Parties (COP21*). The Agreement came into force on 4 November 2016 and was ratified by Croatia on 17 March 2017. The Agreement aims to limit temperature increases below two degrees Celsius compared to pre–industrial levels, compelling future efforts to limit temperature increases to 1,5 degrees. The key long–term goal is to remove, by the middle of this century, the greenhouse gas emission produced by man.

The European Union (EU) is the leader of global climate movement and, in accordance with the agreed goals, has determined the own targets of the 2030 energy policy. Documents such as *A policy framework for climate and energy in the period from 2020 to 2030* [2] and so–called *Winter Package* [3] foresee a 40% cut in greenhouse gas emissions compared

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to the 1990 levels and at least a 27% share of renewables in the total energy consumption. A preferable target is also an energy efficiency increase of at least 30%. It will affect a further trend of decrease in crude oil and petroleum products consumption and the oil industry activities in general. Therefore, the oil companies have already commenced with the implementation of their diversification strategies in other business activities, especially into the renewables, yet also in other markets with growing energy consumption.

Besides, for the oil industry, especially for an oil pipeline and storage infrastructure, it is essential that the EU strategic documents [4] foresee a long–term security of the energy supply through diversification of supply sources and transit routes, thus taking account of the oil–related security and required production and transportation infrastructure.

In compliance with the strategic energy objectives, the *European Energy Security Strategy* [5] foresees the actual implementing measures, such as, to:

- discuss with industry and the Member States how to diversify crude oil supplies to EU refineries with the aim of reducing dependency on Russia;
- identify EU–wide strategic assets in the oil value chain and coordinated action to ensure that consolidation of the EU's refinery capacity occurs in a manner that improves the EU's energy source diversification;
- propose instruments for implementing the strategic infrastructural priorities that will enable competitiveness, environmental sustainability, as well as supply security.

The EU policy is actually realised through the projects of common interest (PCI) [6], representing one of the methods of establishing nine priority energy corridors and three thematic areas, aimed at the more efficient connection of European energy networks, enhancement of supply security, and especially promotion of competitiveness and development and reduction of energy prices.

In order to speed up a successful implementation of PCIs, the 2013 energy infrastructural package, which also includes the *TEN–E Regulation* [7], specified, inter alia, the following: accelerated permitting procedure, reduction of administration costs for project promotors; possibility of receiving a financial support in accordance with the *Connecting Europe Facility (CEF)* [8]. In accordance with the set regulatory framework, the European Commission adopted the first PCI list of 248 projects. The second PCI list of 195 projects (108 related to electric power supply, 77 to gas, *6 to oil and* 3 to advanced networks) was adopted on 18 November 2015, while the third list was adopted on 23 November 2017.

It needs to be highlighted that PCIs are especially intended to strengthen the oil supply security by *oil pipeline connection projects* in Central Eastern Europe given the fact that certain countries are land–locked without sea access and that they import the oil predominately from one direction, i.e. by the Druzhba oil pipeline from Russian direction. Therefore, the PCIs related to oil pipelines are anticipated only for that region within the priority corridor of the *Oil Supply Connection in Central Eastern Europe* (abbr. OSC). At the same time, they represent the only new pipelines planned to be built in Europe, while the PCI entitled *JANAF–Adria Oil Pipelines* is realised by their promotors, MOL, Transpetrol and JANAF.

A special part of the EU oil supply security is the *system of compulsory stocks* of crude oil, which are intended to be available in cases of emergencies or crisis and to be allocated quickly where needed. The EU Member States need to maintain the compulsory stocks equal to at least 90 days of net oil imports or 61 days of consumption, while during the crisis the European Commission is responsible for organising consultations between the EU Member States on placing stocks on the market, except in a very urgent sitution. [9]

Most of the EU countries have already formed the compulsory stocks, even beyond the minimum levels, among which the least was formed by Lithuania (87–day consumption) and the most by the Netherlands (179–day consumption), (as at 22 January 2013) [10]. According to the information by the Croatian Compulsory Oil Stocks Agency (HANDA), Croatia has "available reserves sufficient for the regular supply of crude oil and petroleum product markets" [11]. JANAF's transportation and storage capacities represent an important part of the compulsory stocks system since the crude oil is stored at the Omišalj and Sisak Terminals, while the petroleum products are stored at the Žitnjak Terminal in Zagreb.

Republic of Croatia

In compliance with European strategic guidelines and obligations defined in the *United Nations Framework Convention on Climate Change* (UNFCCC), *Paris Agreement and similar,* the Republic of Croatia is among the first EU members to prepare a *Proposal of Low–Carbon Development Strategy of the Republic of Croatia by 2030, with a view towards 2050* [12]. The key targets to be achieved until 2030 are the following: to reduce the emissions by 7% in sectors outside the ETS (Energy Trade System) compared to the 2005 emissions and to strive towards more ambitious emission reduction. The figures and goals related to the renewables, energy efficiency, CO2 emissions and sectoral goals are specified for the period until 2030 and 2050 in the document entitled *Analyses and Basis for Energy Strategy of Republic of Croatia, Draft of White Paper* [13].

Having in mind the trends of petroleum product consumption, it is important to look at the supply security from the aspect of enhancement of petroleum product production, especially taking into consideration that the Croatian refineries have access to the crudes coming from numerous sources and directions, i.e. the Mediterranean, the Druzhba oil pipeline and national oil fields, whose production is planned to be increased. Next to the refineries, the capacities for storing the compulsory oil stocks are located (at the JANAF's Terminals at Omišalj, Sisak and Zagreb), which also contributes to the energy supply security.

More concrete strategic directions for the future development of the Croatian oil industry shall be defined in a new Energy Development Strategy, planned to be adopted in 2019. Some of the fundamental goals of the oil sector indicated in the 2009 Strategy [14] and some scientific papers [15],[16] will most probably be defined in a new Strategy. They are primarily related to:

- enhancement of supply security of domestic crude oil and petroleum product markets,
- alignment of energy infrastructure with actual requirements in terms of safety and security and environmental protection,
- enabling technological development of energy activities in the oil sector,
- enhancement of crude oil and petroleum product compulsory stocks system.

New Strategy should recognize a *strategic and economic importance of transit and export potentials of transport and storage of crude oil and petroleum products*, along with better utilisation of competitive advantages of sea position, with the aim of more intensive diversification of routes and sources of crude oil and petroleum product supply for the countries of Central and South–Eastern Europe. Furthermore, in order to enhance the supply security, it is necessary to give a strategic and economic significance to the activities of exploration and production of oil and gas, as well as to the oil refining.

Trends in EU and Croatian oil industries

Petroleum product consumption and import dependency

In the last 15 years, the oil consumption in the *EU Member States (EU28)* has decreased from 660 mil. tons in 2000 to 580 mil. tons in 2015, along with the reduction of share in the total primary energy consumption from 38,2% to 34,8% (Figure 1.), and therefore, a conclusion can be reached that those trends were moderately in decline, which nevertheless had a strong impact on the oil industry.

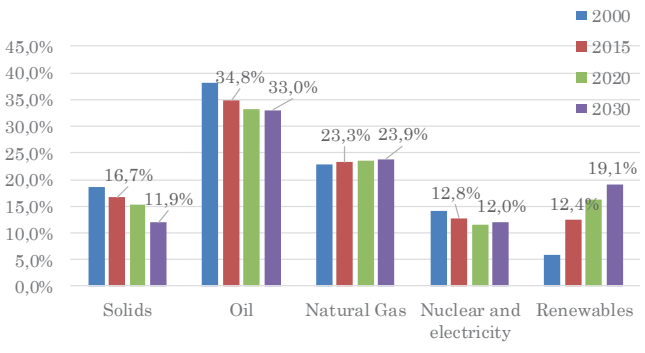

Figure 1. Structure of primary energy consumption of EU28

Source: Calculated based on: European Commission. EU Reference Scenario 2016, Energy, transport and GHG emission, Trends to 2050, European Union., Annex 2, p. 144 [17]

However, a high dependency on imports of crude oil, semi–products and petroleum products of about 96% (Table I.), as a result of decrease of domestic production of crude oil, primarily from the North Sea, and of petroleum products in European refineries, influences the (un)certainty of energy supply to consumers. Thus, one of the strategic directions of the energy policy is to reduce an oil share in the primary energy consumption to significantly lower levels of 33% as predicted by the reference scenario. According to such scenario, a further reduction of oil consumption is foreseen by approx. 67 mil. tons in 2030 compared to 2015, and by 147 mil. tons respectively compared to 2010.

Table I. Oil import dependency EU–28

000 tons EN	2000	2015	2020	2030
Primary energy consumption	1.726.889	1.666.602	1.639.428	1.554.388
Oil consumption	660.025	579.805	545.752	513.151
Oil share in total primary energy consumption	38,2%	34,8%	33,3%	33,0%
Net oil import	532.226	556.140	532.001	513.151
Oil import dependency	80,6%	95,9%	97,5%	100,0%

Source: Calculated based on: European Commission. EU Reference Scenario 2016, Energy, transport and GHG emission, Trends to 2050. European Union, 2016, Annex 2, p. 144 [17]

Croatia consumes 3,7 mil. tons of petroleum products, i.e. approximately the same as in 2010, although with forecasts of a moderate drop to 3,3 mil. tons until 2030. The import dependency related to consumption of crude oil and petroleum products of about 70% (Figure 2.) is more favourable than at the EU level.

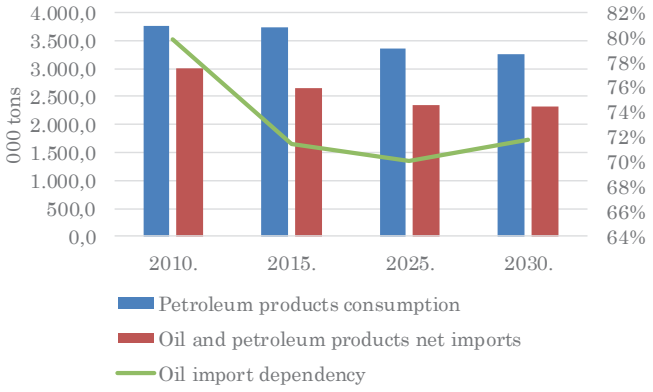

Figure 2. Consumption of petroleum products and import dependency of the Republic of Croatia

Source: Energy Institute Hrvoje Požar (EIHP), "Crude oil and petroleum product market of the users of the JANAF transportation system with estimates of crude oil transport until 2035", Zagreb, October 2016 [18]

How to obtain greater oil supply security?

The security of crude oil supply can be increased through diversification of import routes and sources and through the growth of domestic production of crude oil and its exports being greater than petroleum product imports.

According to the forecasts for EU28, the oil production should amount to only 48,2 mil. tons in 2030, as compared to 70,8 mil. tons in 2016 and 156,6 mil. tons in 2001, [17]. Therefore, the *European Energy Security Strategy* [5] foresees a development of utilising the conventional oil and gas sources in Europe on traditional production fields (e.g. on the North Sea) and newly–discovered fields (e.g. on the Eastern Mediterranean and the Black Sea), entirely in line with the legislation on energy and environment protection. It needs to be pointed out that European oil companies are actively involved in explorations and production of oil and gas in the countries rich in hydrocarbon reserves, although these activities are faced with numerous challenges (e.g. Syria and some countries of the Middle East, North and West Africa and others).

The greatest oil import in Europe in 2016, which amounted to 500 mil. tons, was realised from Russia, i.e. approx. 35,5%, then 12,9% from the West African countries, 12,3% form the Caspian region, 10% from Iraq and others (Figure 3.).

Along with the growing trend of petroleum product import, which amounted to 200 mil. tons, even 44,5% of the same came from Russia, 16,7% from the USA, 6,9% from India, 6,3% from the Saudi Arabia etc.

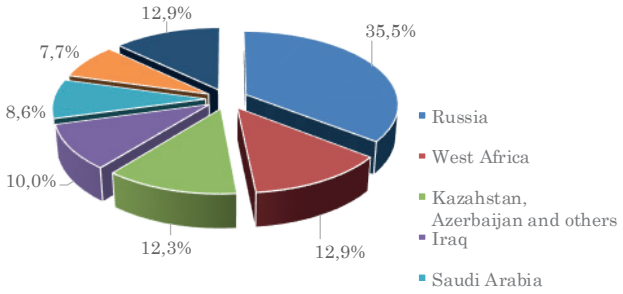

Figure 3. Main oil import routes for Europe

Source: Made based on: BP Statistical Review of World Energy, June 2017 [19]

Given the fact that the import dominance from one route is considered as a fundamental strategic matter of security, the EU policies and activities are directed to the more intensive diversification of supply routes and sources. Namely, about 90% of crude oil is imported into Europe by sea, which gives a desirable flexibility of choices among crude oil sources and directions. Although the transportation costs are changeable, they represent a smaller part of the value as compared to oil, thus enabling an import from distant regions. Most refineries are located on the seaside and thus have direct access to oil through import from the countries of great consumers. The land refineries are supplied by the oil pipelines whose initial points are major ports and/or oil pipelines that are connected to the oil fields on the land.

The refineries of Central Eastern Europe (Poland, Eastern part of Germany, Slovakia, Czech Republic and Hungary) are supplied mainly from the Druzhba oil pipeline. Recently, Polish oil companies have diversified their oil supply, by import from the Middle East countries, Canada, the North Sea and others. To a smaller extent, yet along with the growing trend, Hungarian and Slovakian refineries, since 2013, have been supplied from the Omišalj direction by the JANAF oil pipeline, while the Czech refineries are partially (30%) supplied by TAL pipeline and IKL connection pipeline [20], and there are plans for the transport to be conducted by the JANAF pipeline.

Refineries, predominately supplied from the Druzhba oil pipeline, are vulnerable in case of the supply interruption. Therefore, they need the alternative supply routes that should be provided through some of the following EU oil pipeline projects of common interest [21]:

- Adamowo–Brody pipeline: pipeline connecting Brody (Ukraine) and Adamowo Tank Farm (Poland);
- Bratislava–Schwechat–Pipeline: pipeline linking Schwechat (Austria) and Bratislava (Slovakia);
- JANAF–Adria pipelines: reconstruction, upgrading, maintenance and capacity increase of the existing JANAF and Adria pipelines linking the Croatian Omišalj seaport to the Southern Druzhba (Croatia, Hungary, Slovakia);
- Litvinov (Czech Republic)–Spergau (Germany) pipeline: the extension project of the Druzhba pipeline to the refinery TRM Spergau;
- Cluster Pomeranian pipeline (Poland), including the following PCIs: construction of oil terminal in Gdańsk and Expansion of the Pomeranian pipeline: second line on the Pomeranian pipeline linking Plebanka tank farm (near Płock) and Gdańsk handling terminal;
- TAL Plus: capacity expansion of the TAL pipeline between Trieste (Italy) and Ingolstadt (Germany).

For certain countries (Austria) the PCI Bratislava–Schwechat–Pipeline should represent the second oil supply route through the Druzhba pipeline since at present they realise their imports only through the TAL–AWP oil pipelines from Trieste. Through the realisation of this project, Austria would import less oil by TAL, thus allocating the capacities of this oil pipeline for greater transport for the Czech Republic, yet opening another (3rd) supply route for Slovakian and Hungarian refineries.

At the same time, they represent the only newly planned oil pipelines in Europe. Namely, approx. 22,5 thousand km of oil pipelines run through Europe or approx. 4% of the entire global oil pipeline network [22] and they are mainly 40–55 years old. For comparison, Russia has 80,8 thousand km, and the USA have 240,7 thousand km of oil pipelines.

The implementation of the planned PCI oil pipelines proceeds very slowly, and until now, the only constructed ones are:

Százhalombatta — Šahy (Hungary–Slovakia) oil pipelines and subsea oil pipeline Krk Island–mainland within the project of *JANAF–Adria Pipelines*; and

Gdansk Terminal, 1st phase (375.000 m3 storage tanks for crude oil storing) within the PCI *Cluster Pomeranian pipeline* (Poland).

It is especially important to emphasise that, since 2013, when the project of *JANAF–Adria Pipelines* was adopted on the 1st PCI list, the diversification of supply routes and sources has been realised for Hungarian and Slovakian refineries. It is pointed out that the refineries of these countries in the first years of the 1990s imported up to 4 mil. tons of crude oil. In 2016, the diversification from the sea direction, i.e. Omišalj, amounted to around 12% of the total oil imports, with the trend of growth. By the end of 2016, a *Framework Transportation Agreement* was signed with the Czech Unipetrol. Its realisation provides the Czech refineries with the third oil import route, from Omišalj direction.

Challenges and opportunities and strategic development projects of oil sector, especially as regards oil pipeline and storage activities

The energy and climate policy and trends of oil consumption reducing strongly affect the oil activities. For that reason, the oil companies attempt to find new markets and buyers, improve the range of services and to diversify its activities to the field of storage, but also to the non–oil activities (renewables, electric power supply, petrochemical industry and others), upon which their further development will depend, as well as their existence.

In such process, they will face numerous *challenges, together with opportunities for further development,* such as:

- Global refinery and petrochemical sector outside Europe grows, while new high–technology refinery and petrochemical complexes from the Middle East and Asia expand the imports in Europe. Besides, the import from the USA also grows, considering that the US refineries take the advantages of a significant increase in domestic oil production and construction of oil pipelines and storage capacities over the last years.
- On the global level, further overcapacity of refineries is expected, which implies competition strengthening, new shutdowns (in Europe, 24 refineries since 2007) and others. European refineries are also less complex compared to new Asian refineries and 40 and more years old with a focus on gasoline configuration. The ones, which have competitive advantages based on volumes, locations and complexity, will survive.
- Regulation and local policies of the refining, and the EU oil sector are additionally burdened by the companies' operating expenses (substantially more than in Asian countries and the US), besides their importance in the security of energy supply, to consumers of around 35%.
- Further integration of oil companies is foreseen (with the aim of increasing the competitiveness and responses to ever stronger challenges) through both vertical (along with the petroleum–gas–petrochemical chain) and horizontal integrations.
- Refineries change their business operations management from the refinery driven concept towards supply chain integration, with the refining being more oriented to a combination of crude oil grades taking account of sales of the most profitable products.
- The upstream activities related to oil (and gas as well) are faced, due to the energy and climate policy and the EU legislation, with numerous restrictions affecting a further decrease in the European production, although the domestic production represents one of the key pillars of both the supply security and the import independence. On the other hand, the stimulated production grows in the US and other regions and therefore, the imports of crude oil and petroleum products, in many aspects, contribute to weakening the European oil sector and thus to the economy and its competitiveness. The development of the renewables could not make up for the negative economic effects arisen from the decrease in activities of the oil operations, especially with less developed European states.
- The oil trading companies wish and intend to integrate and/or develop more oil and compatible activities, invest in the development of oil infrastructure in less developed regions, expand the market and locations of crude oil and petroleum product production as well as storage (e.g. JANAF's Omišalj Terminal, Ploče Terminal and others).
- The oil pipeline companies develop new business for their more successful performance offering more and more to oil companies also storage, possibilities of transport of several crude oil grades from a greater number of routes and other services. At the same time, they represent an important part of the supply security system in crisis and emergencies, since they store the compulsory stocks of crude oil and petroleum products.

Having in mind the fact that in the next two decades the considerable crude oil quantities will be consumed and that the oil will remain a dominant energy source, *strategic directions of European oil companies* should, among other things, be related to:

- investments in the capacities modernisation, their maintenance, environmental protection and safety of humans and facilities;
- construction of capacities in the chain from exploration, production, distribution and consumption on new locations, especially in the regions rich in hydrocarbon reserves, in less developed countries with emerging economies and petroleum product markets;
- construction of European connection oil pipelines in accordance with the EU policies and projects of common interest (see point 2.2.2.), yet in other parts of the world as well.

On their way to contributing to a low–carbon economy, oil companies develop projects contributing to the reduction of greenhouse gas emissions, thus ensuring long–term successful business operations and growth [23]. Such activities and projects will be presented in the continuation of the paper, particularly for some major oil companies, like Shell, Exxon Mobile end others, as well as for some medium– sized oil companies in the Central and South Eastern Europe, such as MOL, NIS, etc.

Following new energy climate policies, the activities of *Shell* company are directed to [24]:

- construction of wind power plants in North America and Europe of 1.000 MW capacity, yet also to expanding the operations related to natural gas that will replace the coal in thermal plants;
- investments in biofuels (e.g. JV Raizen in Brazil) and explorations in the second generation of biofuels;
- pilot projects of using LNG in transport;
- development of the first broad network of hydroelectric vehicles in Germany;
- enhancement of technologies of CO2 capture and storage, in which Shell is the leader;
- researches as regards use of traditional oil and gas based fuels in vehicles, along with green and clean technology (Shell Technology Venture);
- reduction of emissions and continued efforts in improvement of energy efficiency.

British Petroleum [25]**,** assisted by a number of institutes, develops a complex, interactive and sustainable programme "Energy Sustainable Challenge", studying and researching the relations between natural sources and the energy supply and demand. The model also comprises the research on the future of biomass to be used at different CO2 emission regimes and technological scenarios, which would give to the policy creators more strategic understanding on bioenergy and its potential influences.

British Petroleum is focused on investments in low–cost and low–carbon biofuels. The biofuels are mixed with the gasoline or diesel without significant engine modifications or major changes to the existing distribution systems. A Brazilian company produces biofuels from sugarcane together with the production of around 640 mil. litres of ethanol and employment of 6.000 people. The sugarcane waste is further used for the electricity production of up to 170 GWh, and in new plant even up to 340 GWh annually.

ExxonMobil [26] contributes to greenhouse gas reduction through the following strategic projects and activities:

- reduction of emissions from its own operations;
- development of the next generation of technologies intended for CO2 separation, compression and underground injection;
- finances and researches related to biofuels;
- advancement of technologies as regards vehicles and fuels, including enhancement of plastic parts and use of hydrogen fuel cell in vehicles and others.

OMV [27] sees the answers to challenges in the future through investing in development and exploration of new energy and technology sources,

as well as directly through enhancement of efficiency of energy source utilisation.

With the aim of achieving this goal, the company is focused to creating an appropriate infrastructure for ensuring the mobility of hydrogen as fuel, indirect conversion of electricity into hydrogen and direct conversion of solar energy into hydrogen, then to producing the advanced biofuels for diesel and kerosene substitution, as well as to chemical recycling of plastic waste.

Specifically, it means to:

- create a national network of 400 stations for hydrogen fuel cell filling for electric cars in Germany, until 2023;
- explore and develop the advanced biofuels, such as the use of micro seaweed for competitive production of aviation fuel;
- produce a synthesis gas from CO2 and water, which would represent a renewable energy source, and, at the same time, would be neutral from the emission aspect;
- focus on gas as cleaner fossil energy source for the electricity production, as well as on carbon and water management in order to achieve eco–efficiency along with the reduction of greenhouse gas emissions and efficient water management and use.

KEY ROUTES OF CRUDE OIL SUPPLY, EUROPEAN OIL PIPELINE NETWORK AND JANAF'S STRATEGIC POSITION

The EU holds small oil reserves, only about 0,3% of the global reserves, and low falling production, and therefore it is a major oil importer with 88% dependency of the total consumption (Figure 4.). The overall oil consumption in 2016 amounted to 13,9% [19], of the total global consumption that places the EU on the second place in the world, right after the USA. In Europe, only the Great Britain, Denmark, Norway, Italy and Romania have significant oil production.

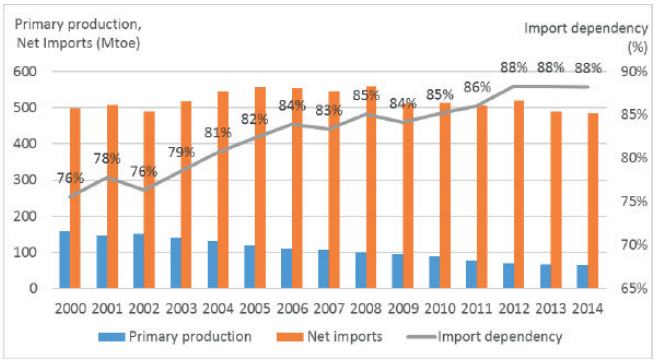

Figure 4. Crude oil production and net imports in Europe (2010–2014)

Source: Cambridge Econometrics: A Study on Oil Dependency in the EU, July 2016 [28]

The main supply routes of oil imports for Europe are: from the Norwegian oil fields, through the Norpipe oil pipeline; from the Middle East countries, Africa, Caspian region, Russia and America by sea to the oil ports on the North Sea and the Mediterranean; and from the Russian direction by the Druzhba pipeline.

Therefore, only Russian and Norwegian crude oil is transported into Europe by oil pipelines (about 20% of the total imports), while the remaining quantities arrive by tankers to the oil terminals and the sea ports like Rotterdam in the Netherlands, Le Havre and Marseille in France, Hamburg in Germany, London and Teesside in England, Trieste in Italy, Omišalj in Croatia, etc. [28].

The main oil pipelines transporting crude oil to Europe and within Europe can be classified into four categories: [29]

- Norwegian oil pipeline, Norpipe,
- Russian oil pipelines,
- Caspian oil pipelines,
- *European oil pipeline network (added by authors).*

Norpipe

Norpipe oil pipeline was constructed in 1975, after the discovery of oil fields in the North Sea in the 1960s. Its starting point is in the territorial water of the Norwegian Sea, and through the British Sea arrives at the Teesside Port in England, having the length of 354 kilometres (km). The pipeline transports crude oil from the Norwegian oil fields of Ekofisk, Eldfisk, Embla, Tor, Valhalla, Hod, Ule Gyda and Tamber, as well as from several British oil fields. The pipeline capacity used to be 45 million tons (MT), and today is reduced to 39 MT.

Druzhba pipeline

Druzhba represents the major supply oil pipeline for Europe, and it is the largest among the Russian oil pipelines (Figure 5), forking into the North and South branch, having the total capacity of 64 MT. With its length of approx. 5.100 km, it is considered the world longest oil pipeline.

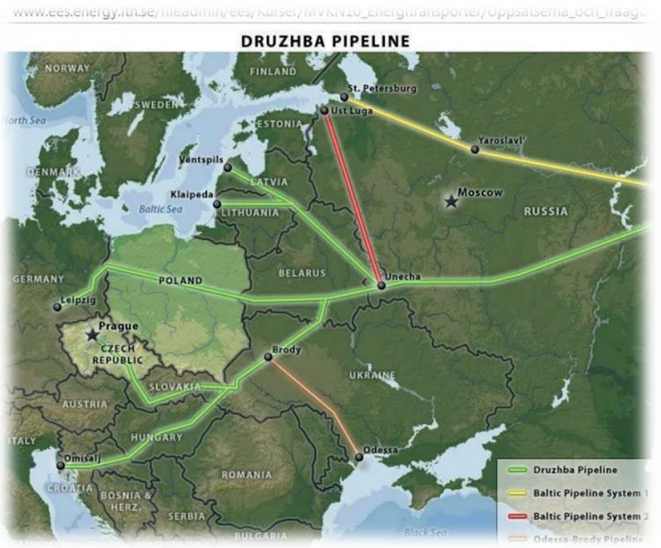

Figure 5. Druzhba Pipeline, Baltic Pipeline Systems 1 and 2 [30]

The initial pipeline point is Tatarstan in Russia, where the crude oil is collected from the Western Siberian oil fields, the Urals and the Caspian lake, and it proceeds to Mozyr in Belarus, where it forks into the North and South branch. The current flowrate through Mozyr in Belarus amounts to approx. 64 MT [31]. The North branch runs through Belarus and Poland, supplying the Plock refinery in Poland and the Schwedt and Leuna refineries in Germany. In Germany, the Druzhba pipeline is connected to the Rostok Port by means of the MVL pipeline. In Poland, the North branch is connected, by means of the Plock–Gdansk oil pipeline, to the Polish oil terminal in Gdansk. The pipeline south branch forks into Druzhba 1, extending to Bratislava in Slovakia and Prague in the Czech Republic, and Druzhba 2, extending to Szazhalombatta with a possibility of supplying Hungary directly, as well as Croatia, Bosnia and Herzegovina and Serbia by means of the JANAF pipeline. Druzhba 1 and Druzhba 2 are interconnected through the oil pipeline between Šahy in Slovakia and Szazhalombatta in Hungary.

Baltic Pipeline System 1 (BPS–1)

Another major oil pipeline system is the Baltic pipeline, transporting the crude oil from Russian oil districts in the Western Siberia and Tyumen–Pechora in the west direction to the newly constructed port of Primorsk on the Baltic Sea, having the export capacity of 76,5 MT (Figure 5.). BPS provides Russia with a direct access to the North European markets, thus reducing the dependency on routes extending through the Baltic countries, Belarus and Poland.

Baltic Pipeline System 2 (BPS–2)

The second route of the Baltic pipeline connects Unecha and the Baltic port of Ust–Luga. BPS–2 (Figure 5.) has the total designed capacity of 30 MT, amounting to 36 MT with the capacity expansion made in 2017. Thus, Russia is enabled to supply the crude oil directly to the users in Poland and Germany, without being dependent on transit states. It is important to emphasise two issues regarding the Baltic oil pipelines — ports frozen even up to two months per year and price difference as regards the crude

oil supply, compared to the Druzhba, of about USD 3 per barrel. Nevertheless, Russia sees it as minor problem compared to what it has gained by the Baltic pipeline system.

Caspian Pipeline Consortium (CPC)

The CPC pipeline is 1.511 km long and transports the Caspian crude from the Tengiz and Karachaganak fields, as well as from new huge offshore field of Kasaghan (light crude of high quality) to the Black Sea port of Novorossiysk on the Russian coast (Figure 6.). It represents the main export route for the Kazakh crude, and in 2018, the capacities were increased from 28 MT to 67 MT. By the end of 2018, 5.400 tankers were loaded and 580 MT of crude oil was transported, while only in 2018 the transport reached 55 MT [32]. The CPC pipeline is the only oil pipeline that runs through the Russian territory, and that is not in the majority ownership of Transneft, company which is the operator of the Russian oil pipeline system, but it is 24%–owned by the Russian Federation. Other owners include: Kazakh national company KazMunaiGaz, Chevron CPC, LUKARCO B.V., Mobil CPC, Rosneft–Shell, and others.

Figure 6. Caspian pipelines [33]

Baku–Tbilisi–Ceyhan (BTC)

The BTC oil pipeline transports crude oil from the Azeri–Chirag–Deepwater Gunashli (ACG) field and the condensates from the Shah Deniz field, through Azerbaijan, Georgia and Turkey to the Port of Ceyhan on the Mediterranean. The oil pipeline transports both Turkmen and Kazakh crude. It was constructed in 2006. It has the total length of 1.768 km. Upon expansion made in 2009, and by use of DRA (drag reducing agents), the pipeline capacity amounts to 60 MT. By the end of 2018, BTC has transported around 417 MT of crude oil, while in the Port of Ceyhan 4.085 tankers were reloaded [34].

European oil pipeline network

The oil entry points to the EU Member States on the land part are located on few locations: Teesside in the United Kingdom, Adamowo (Polish–Belarusian border), Budkovce (Slovakian–Ukrainian border), Fenyestlikte (Hungarian–Ukrainian border). Thus, three of four oil pipeline entries on the EU territory continue to the Druzhba pipeline (Figure 7. and Table II.).

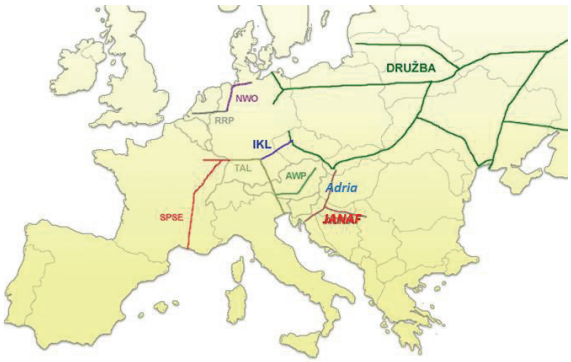

Figure 7. European oil pipeline network

Table II. Major European oil pipelines

Oil pipelines	From - to	Year of construction	Length (KM)	Capacity (MT)	Transport in 2016 (MT)
TAL	Trieste-Karlsruhe	1967	754	54	41,4
AWP	I/A border-Swechat	1967	420	11	8,1
SPSE	Fos sur Mar (Marseille)-Karlsruhe	1962	769	36	22,0
MOL	U/H border - H/Cro border	1963	848	23	7,0
NWO	Wilhelmshaven-Koln	1958	391	15,5	18,1
NDO	Wilhelmshaven-Hamburg	1983	144	11,5	4,8
MVL	Plock-Spergau	1963	365	22,5	21,8
TRANSNAFTA	Sotin-Pančevo	1979	154	6	2,9
RRP	Rotterdam-Wesseling	1960	323	22	16,0
MERO (Družba, IKL)	S/Cz border - Litvinov	1965, IKL 1996	505, IKL 170	9, IKL 11,5	9,0
TRANSPETROL	H/S border - S/Cz border	1962	1.032	20	11,0
JANAF	Omišalj - Sotin - Gola	1979	631	24	7,2

Source: Energy Data Base, JANAF

Note: I–Italy, A–Austria, U–Ukraine, H–Hungary, S–Slovakia, Cz–Czech Republic, Cro–Croatia

NWO is the first major European pipeline, constructed in 1958. The pipeline capacity amounts to 22 MT, having the diameter of 71 cm and the length of 391 km. It supplies four refineries in Germany and in 2016 its transportation quantities amounted to 18,1 MT. In total, the pipeline transported one billion tons of crude oil, and 19.000 tankers were reloaded. It accounts for 20% of the share of the total German supply.

Soon after NOW, the *Rotterdam–Rhine Pipeline (RRP)* was constructed, with the diameter of 60 cm, and the length of 300 km. Then, the pipeline has been extended by 150 km up to the area around Frankfurt. Today, the pipeline length is 479 km and it connects Rotterdam and the German district of Ruhr, while its maximum capacity is 16 MT.

South European Pipeline (SPSE)

SPSE was put into operation back in 1962. It connects Lavera (French port), through Strasbourg, to Karlsruhe (Germany). It is 782 km long, with the diameter of 86 cm and the maximum capacity of 36 MT. The greatest crude oil transport amounted to 43 MT (in 1973). The present transportation level reaches about 23 MT of crude oil annually. Afterwards, in Karlsruhe, the pipeline connects to the Rhine–Danube Pipeline (RDO), it is 280 km long and connects the Karlsruhe and Ingolstadt refineries.

Trans Alpine pipeline (TAL)

The Transalpine Pipeline (TAL) connects the Port of Trieste in Italy with Ingolstadt in Germany, and on its route, it supplies with crude oil five refineries in Austria and Southern Germany. TAL transports crude oil for the Schwechat Refinery (OMV) in Austria, by means of the AWP connection pipeline, then for Bayernoil refineries of Vohburg and Neustadt, MIRO refinery of Karlsruhe, Esso refinery of Ingolstadt and OMV refinery of Burghausen (by the OMV pipeline) in Germany, and further through the Czech IKL connection pipeline supplies the Czech refineries of Kralupy and Litvinov, near Prague. In 2016, the transport by TAL amounted to 41,4 MT, while the number of tankers unloaded in the Port of Trieste reached 499. [35] The pipeline length amounts to 754 km, while its tank farm storage capacity in Trieste amounts to 2.033.000 m3 and in Ingolstadt to 350.000 m3.

MERO pipeline

The Czech Republic has two refineries, Kralupy and Litvínov. The Litvinov Refinery is supplied by crude oil from Russia and is designed for refining the crude oil of REB grade. The Kralupy Refinery refines mostly the low–sulphur crudes supplied from the Middle East and other sources, and delivered by the TAL and IKL pipelines [28]. The Czech section of Druzhba (South Druzhba) has a capacity of 9 MT, while the other oil pipeline route, Ingolstadt–Kralupy–Litvínov pipeline (IKL), which takes the crude oil from TAL, has a capacity of 11,5 MT/annually. The IKL pipeline was constructed in 1996, as an alternative to the Druzhba pipeline [36]. The operator of both pipelines is the Czech national oil transportation company MERO.

Transpetrol pipeline

Transpetrol is the operator of the 1.032 km long oil pipeline, in Slovakia, which supplies the Bratislava Refinery and serves for transit towards the Czech refineries in Kralupy and Litvinov. The main supply pipeline of the refinery is a part of Druzhba, and on the Slovakian territory, is almost completely reversible. Its capacity is 20 MT/annually, and currently, more than half of capacity is used for the supply of Slovakian and Czech refineries. The other crude oil supply route comes from the Omišalj direction, by the Croatian JANAF pipeline, the Hungarian Adria pipeline and the Šahy–Szazhalombatta pipeline (Slovakian–Hungarian pipeline).

MOL pipeline

The pipeline is 848 km long, and its total capacity amounts to 23 MT. The pipeline system is operated by the Hungarian oil company MOL [37]. It is connected to other pipelines in the surrounding region on three points and can be supplied by crude oil from two directions (Druzhba and JANAF/ Omišalj). It supplies the refineries in Hungary and also serves for crude oil transit towards Slovakia and the Czech Republic. All crude transported by the Druzhba pipeline is of Russian origin, while the Adria branch, coming from the JANAF direction, transports the crudes from Africa, Iraq, Kazakhstan and others. At the same time, that route is of strategic importance since it enables the diversification of sources and security of supply, as well as higher refining profitability. In February 2015, MOL and Slovakian Transpetrol have, by constructing a new pipeline, expanded the capacity of the Szazhalombatta — Šahy pipeline section from 3,5 MT to 6 MT, which should contribute to substantially higher security of supply by the import of greater crude oil quantities from the Omišalj direction.

JANAF pipeline and its strategic importance in crude oil supply of South Eastern and Central Europe

JANAF has been a significant storage pipeline with storage capacities for crude oil supply of the South Eastern and Central European countries for almost forty years now (since 1979). For foreign refineries, it transports about 65% of the total oil quantities, with a growing trend. The crude oil is transported for six (6) countries and nine (9) refineries in Croatia, Bosnia and Herzegovina, Serbia, Hungary, Slovakia and soon also in the Czech Republic (Figure 8.). It is a respectable market of around 30 mil. tons of petroleum product consumption.

Figure 8. JANAF's connection to global oil sources and European oil pipeline network

The initial point of the oil pipeline system is on the coastal Terminal and Port of Omišalj, located on the island of Krk on the North Adriatic. The pipeline runs through the entire Croatian territory in the length of 631 km. The storage capacities are also located throughout Croatia on four locations — Omišalj, Sisak, Virje and Zagreb. Nowadays (at the beginning of 2019) JANAF has 1,94 mil. m3 of storage tanks available for crude oil storage and 222.000 m3 storage tanks available for petroleum product storage. The storage tanks are, to the largest part, located on the Omišalj Terminal, which represents a strategic part of the Mediterranean oil market. In the last five years, the crude oil and petroleum products storage capacities doubled. Thus, one of the strategically important goals has been achieved, namely the diversification of business operations towards storage, which today accounts for approx. 40% of the company's operating revenues. The crude oil is stored at the Omišalj Terminal by major international oil companies, such as Vitol, Glencore, MOL, and soon also by other companies.

The successful achievement and implementation of the development and business strategy is enabled owing to the enhancement of the environmental protection and security of transport and storage, by investing into modernisation of the oil pipeline and storage system (new SCADA system, electric power supply system, and others), pipeline rehabilitation, storage tanks repairs and overhauls, and others.

In accordance with the objectives of the EU and Croatian energy policies, JANAF has a special importance as regards the enhancement of the security of crude oil supply. The EU has recognised precisely that strategic role of the JANAF pipeline through the project of common interest (PCI), *JANAF–Adria Pipelines,* whose aim is to diversify the supply routes and sources, through the crude oil import precisely from the Omišalj direction.

In that respect, the encouraging results have been achieved, and thus, since 2013, the oil transportation has been restored again for Hungarian and Slovakian refineries, and the same is also expected for the Czech refineries. At the same time, they represent the markets on which JANAF can increase the market share and where there are possibilities of further growth for oil transportation. The possibilities of the transportation growth are also observed with the refineries in Croatia, Bosnia and Herzegovina and Serbia, given the fact that these countries foresee an above–average growth of the economy and living standard.

The *subsea pipeline Krk island–mainland* that recently has been put into regular operation (August 2017) and that replaced the crude oil transport conducted in the last 38 years through the Krk bridge, will contribute to the supply and transport security.

It is important to emphasise that the recent construction of facilities for improving the operations and capacity utilization at the Omišalj Terminal, as well as of the storage tanks, has created new business and development opportunities for JANAF, local communities and the Republic of Croatia. Thus, Omišalj obtains the brand of the *Adriatic Centre for storage of crude oil and petroleum products* with storage capacities for crude oil of 1,4 mil. m3 and for petroleum products of 80.000 m3.

In order to respond to ever greater challenges, JANAF intensively cooperates with oil companies and is headed towards the development of new services (bio–fuels and additives adding, crude oil blending, and others) in order for the oil companies to be able to import crude oil from the Omišalj direction, to process several crude oil grades and to conduct their business operation more successfully.

Moreover, JANAF considers a possibility of gradual transition into more complex company, which implies a potential development of projects related to renewables (solar, etc.) yet also of projects related to the local community, with the aim of the company's further growth, as well as its contribution to realization of the policies related to the climate and low–carbon economic development, and especially to enhancing the security of the energy supply.

MAJOR PLAYERS IN EUROPEAN OIL SUPPLY

The business operation and development of the European oil industry are conducted within the framework and under the influence of major oil companies, to mention just a few: Royal Duch Shell, British Petroleum, Total, Rosneft, Lukoil, ENI, Glencore, Vitol, Trafigura and others. In the Central Eastern Europe, the largest oil and gas companies that are in the process of globalisation and growing (spreading their businesses on the new markets, buying new companies, entering into new non–oil activities) are OMW, PKN Orlen and MOL. (Tables III. and IV.).

Table III. Revenues of some of the major integrated oil companies in the 2014–2016 period (in mil. USD)

	2014	2015	2016
Shell	421.105	264.960	233.591
British Petroleum	214.730	145.890	135.630
Total	212.018	143.421	127.925
Rosneft	95.679	89.541	86.724
Lukoil	122.800	85.360	71.160
ENI	98.218	72.286	55.762

Table IV. Revenues of some of the major European trading oil companies in the 2014–2016 (in mil. USD)

	2014	2015	2016
Glencore	221.073	170.497	152.948
Vitol	270.000	168.000	152.000
Trafigura	126.200	97.200	98.100

Royal Dutch Shell [24] is an Anglo–Dutch multinational oil company, established in 1907, by merging Royal Dutch and Shell Transport & Trading. Shell is a vertically integrated company with the activities in almost all areas of the oil and gas industry. It operates in over 70 countries worldwide and employs around 90.000 employees. Royal Dutch Shell produces 3,7 million barrels of crude oil per day and sells 57,1 million tons of liquefied natural gas per year. In 2016, its revenues amounted to USD 233,6 billion.

With the crude oil discovery in Persia back in 1908, begins a story of one of the most significant companies in the world — *British Petroleum* [25]. Until 1954, the company was called Anglo Indian Company, when it chan-

ged the name to BP. Its registered office is in London, it operates in over 70 countries and employs around 75.000 employees. Its 2016 revenues amounted to USD 135,6 billion. The company produces 3,3 million barrels of crude oil per day.

Total [38] was founded after the First World War, when the French Prime–Minister, Raymond Poincaré refused to form a partnership with Royal Dutch Shell. Total was founded back in 1924, under the name of Compagnie française des pétroles (CFP). At that time, the company's primary activity was the oil production in the Middle East. The successful management of the company over the last 100 years has resulted in Total being the fourth largest producer of oil and gas, operating in over 130 countries. It employs around 100.000 employees and is a leading company in the liquefied petroleum gas industry. The company has 16.400 filling stations and 4 million clients daily.

Rosneft [39] is a major Russian oil company with its registered office in Moscow. It was founded in 1993, as cartel composed of several hundred smaller companies and organisations that operated in the former Soviet Union. At the beginning of 2001, with the economic growth, the company's growth and successful performance were achieved owing to the accepted strategy that enabled the development of geological explorations, an increase of hydrocarbon production, development of refining capacities and entry on new markets. In 2016, the company produced 210 MT of crude oil, condensates and gas, and has over 2.962 filling stations and 18 refineries, of which 13 are located in Russia.

ENI [40] is an Italian oil company of global characteristics, operating in 71 states and employing 33.000 employees. E. Mattei founded the company in 1953, in order to make it an international one. With growing hydrocarbon production, the record production of 1,82 million barrels per day was achieved in 2018. ENI owns the refineries in Italy and Germany, whether they are 100%–owned or partially owned by ENI. They are the first in the world to convert the refinery (in Venice) into a biorefinery, and they plan to do the same with the refinery in Sicily.

Lukoil [41] is also a vertically integrated oil and gas company, whose production accounts for more than 2% of the entire global oil production and for 1% of hydrocarbon production. The company was founded in 1991 and since then, it has become one of the strongest players in both Russian and European markets. Lukoil produces 1,3 million barrels of crude oil per day and has 5.390 filling stations. The company's registered office is in Moscow, and it employs over 100.000 employees.

Glencore [42] is an Anglo–Swiss multinational company founded in 1974, whose activity relates to the trading of crude oil and petroleum products, as well as other commodities. At the same time, Glencore is the largest Swiss company and major world trader. It employs around 150.000 employees in over 50 countries worldwide.

Vitol Group [43] was founded back in 1966. The company is a major independent energy trader, with revenues amounting to USD 153 billion in 2016. The company controls 250 supertankers and other vessels that transport up to 350 million tons of crude oil annually. It employs more than 5.000 employees worldwide.

Trafigura [44] is also among the leading global companies for commodity trade. It was founded in 1993, having its registered office in Switzerland. In 2016, the company's revenues are realised in the amount of USD 98,1 billion. The company employs more than 4.000 employees.

The company which is also relevant for European oil supply is *Transneft* [45] an operator of the majority of the oil pipeline system of the Russian Federation. It was founded in 1993. It transports about 90% of crude oil and 30% of petroleum products produced in Russia, by the oil pipeline which is approx. 70.000 kilometre long. The company's revenues in 2016 amounted to USD 12,6 billion.

Among major global oil and gas companies in Central Eastern Europe, the following ones need to be mentioned, *OMV*, *PKN Orlen and MOL Group*.

OMV [27] is an Austrian global oil–gas–petrochemical company with the total revenues of USD 22,8 billion, employing 22.544 employees in 2016 and operating in 30 states. It was founded in 1956. Its significant complex refinery capacities (17,8 MT) are located in Austria, Romania and Germany. Moreover, it operates the network of 2.000 filling stations in 10 countries. It produces 311 thousand barrels of oil equivalent per day, of which 90% in the EU Member States.

PKN Orlen [46] is a Polish integrated oil–gas–petrochemical company with 22.000 employees and USD 21,7 billion of revenues realised in 2016. It owns the refineries in Poland (Plock), Lithuania and the Czech Republic (Kralupy and Litvinov), 2.679 filling stations (Poland, Czech Republic, Germany, Lithuania). It has access to the Druzhba pipeline and the ports of Butinge and Gdansk. The company performs the activities of oil and gas exploration and production in Poland and Canada, as well as in Germany. It produces 32,4 MT of petroleum products and 5,4 MT of petrochemical products.

MOL Group [37] is a Hungarian integrated oil and gas company. MOL was founded in 1991. It operates in more than 30 countries and employs 25.000 employees. Its total revenues amounted to USD 12,6 billion in 2016. It produces around 112 thousand barrels of oil equivalent per day. MOL Group has, within its structure, also the refineries in Hungary and Slovakia (complex and competitive) and in Croatia, as well as in Italy (distribution centre) that produce up to 417.000 barrels of petroleum products per day. MOL Group manages over 1.600 filling stations located in 10 countries Europe wide.

It is significant for all oil and gas companies that they intensively diversify their business operations to non–oil activities, mainly to renewables, electric power supply, automotive industry, petrochemical industry and others. Furthermore, owing to the energy efficiency programmes, technical and technological advancements and similar, they reduce the CO2 emissions and contribute to the realisation of the climate change policies.

CONCLUSIONS

The entire resources of the planet that we live are limited. Thus, the question of finding the alternatives imposes by itself. In the modern world, there is a constant struggle for control over the oil and gas reserves. Just to mention that 2/3 of oil reserves and 1/3 of natural gas reserves are found on the Middle East.

A dominant question of major forces concerns the preservation of influence in these areas. In such global relations, the Republic of Croatia holds a geostrategic position as a Mediterranean and transit country. Thus, the efforts are undertaken to successfully respond to numerous challenges related to providing the sources of the Croatian economy growth. Therefore, the development of oil and storage activities is essential, as well as the establishment of strategic partnerships in oil sector together with the more efficient use of infrastructure and corridors.

The European oil pipeline network was constructed in the 1960s, except for the JANAF and IKL pipelines that were constructed afterwards. The oil pipelines are generally considered as the most cost–efficient and the safest mode of crude oil transport, with a high–reliability level and low maintenance costs. With reference to consumption trends of oil and other energy sources, as well as realized and expected technical and technological achievements, especially in the field of energy efficiency and renewable energy sources, transportation and similar, but also to the oil and gas industry, it is obvious that the pipeline transportation of oil will be used in the decades to come.

The oil pipelines represent the fundamental energy infrastructural facilities of the energy supply security of the EU and the Republic of Croatia. They link the refineries with the import oil ports and land oil sources. Therefore, through the EU legislation and actual projects, the construction of six (6) connection oil pipelines with terminals as the EU projects of common interest, is encouraged and anticipated. Until now, only JANAF, MOL and Transpetrol as project promoters have independently realized the common project entitled *JANAF–Adria Pipelines*, aimed at crude oil supply from the Omišalj direction in the Central Eastern European countries, which today dominately import the crude oil from one direction, i.e. the Druzhba pipeline and Russia respectively. PCI pipelines are, at the same time, the only new oil pipelines planned to be built in Europe as opposed to, for instance, the USA, Canada, Russia, China, etc. In this respect, JANAF plays an important role, since it provides, to the countries of Central and South Eastern Europe, a possibility of crude oil imports from the Omišalj direction, and thus from numerous routes and sources, and from the Druzhba pipeline as well.

Given the fact that until 2030, a significant share of crude oil is foreseen of 30% in the primary energy consumption, the oil pipeline and storage companies, as well as other oil companies, have a social responsibility as regards the oil supply security, which can be achieved only by investments into modernizations, reconstruction and upgrades of the existing capacities, yet also into new operating activities and markets, in order to achieve further companies growth and ensure funds for maintaining the facilities in the circumstances of reduced oil activities.

The oil and gas companies intensively diversify their business operations to non–oil activities, mainly to the renewables, electric power supply, automotive industry, petrochemical industry and others. Furthermore, owing to the energy efficiency programmes, technical and technological advancements and similar, they reduce the CO2 emissions and contribute to the realisation of the climate change policies.

REFERENCES

[1] B. Dudley "The Energy Outlook explores the forces shaping the global energy transition out to 2040 and the key uncertainties surrounding that transition", BP Energy Outlook 2019 edition, BP p.l.c. 2019

[2] COM, 15 final, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "A policy framework for climate and energy in the period from 2020 to 2030", Bruxelles, 22.1.2014.

[3] COM, 860 final, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, "Clean Energy For All Europeans", Bruxelles, 30.11.2016.

[4] COM, 639 final. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, "Energy 2020 a strategy for competitive, sustainable and secure energy", Bruxelles, 10.11.2010.

[5] COM, 330 final, Communication from the Commission to the European Parliament and the Council, "European Energy Security Strategy", Bruxelles, 28.5.2014

[6] G. Sekulić, F. Đedović, A.A. Lopac, M. Lasić, I. Štritof, "EU Projects of Common Interest — benefits for companies, Croatian and Central Eastern European region", IX International Conference and Exhibition "Oil and gas economy and primary energy", Šibenik, 2017

[7] "Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans–European energy infrastructure", OJ EU L 115/39

[8] Regulation (EU) No 1316/2013 of the European Parliament and of the Council of 11 December 2013 "Establishing the Connecting Europe Facility", amending Regulation (EU) No 913/2010 and repealing Regulations (EC) No 680/2007 and (EC) No 67/2010"

[9] Council Directive 2009/119/EC of 14 September 2009, "Imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products", OJ EU 265/09

[10] http://ec.europa.eu/energy/en/topics/imports–and–secure–supplies/eu–oil–stocks

[11] http://www.handa.hr/images/stories/izvjesc_2017/tjedni_izvjestaj_25_17_19__06_2017.pdf

[12] Republic of Croatia, Ministry of Environment and Energy, "Proposal of Low Carbon Development Strategy of the Republic of Croatia by 2030, with a view towards 2050", Zagreb, June 2017

[13] Energy Institute Hrvoje Požar, "Analyses and basis for Energy Strategy of Republic of Croatia, Draft of White Paper", February 2019

[14] Croatian Parliament, "Energy Development Strategy of the Republic of Croatia", Official Gazette No. 130/2009

[15] D. Karasalihović Sedlar, L. Hrnčević, I. Dekanić, "Possibilities for implementation of Energy Strategy of the Republic of Croatia", Strojarstvo, 52, 6, 621–629, Zagreb, 2010.

[16] D. Karasalihović Sedlar, L. Hrnčević, I. Dekanić, "Recommendations for implementation of Energy Strategy of the Republic of Croatia", Energy, 36, 4191–4206, Zagreb, 2011.

[17] European Commission, "EU Reference Scenario 2016, Energy, transport and GHG emission, Trends to 2050", European Union, 2016

[18] Energy Institute Hrvoje Požar (EIHP), "Crude oil and petroleum product market of the users of the JANAF transportation system with estimates of crude oil transport until 2035", Zagreb, October 2016

[19] BP Statistical Review of World Energy, 2017 and other editions

[20] SWD, 330 final. PART 1/5, Commission staff working document, "In–depth study of European Energy Security", Accompanying the document Communication from the Commission to the Council and the European Parliament, European Energy Security Strategy, COM, 2014

[21] C, 8052 final, Annex 1, Annex to Commission delegated regulation (EU) …/... amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards "The Union list of projects of common interest". Bruxelles, 18.11.2015.

[22] https://en.wikipedia.org/wiki/List_of_countries_by_total_length_of_pipelines

[23] JANAF, Study, "Terms of reference and guidelines of JANAF's development in the 2017–2021 period and development strategies to 2030", Zagreb, 7 April 2017

[24] http://www.shell.com/

[25] http://www.bp.com

[26] https://corporate.exxonmobil.com/

[27] http://www.omv.com/

[28] Cambridge Econometrics, "A Study on Oil Dependency in the EU", 2016

[29] S. Nies, "Oil and Gas to Europe", IFRI, 2011

[30] https://www.google.hr/search?q=baltic+pipeline+system+1+and++2

[31] ILF & Purvin&Gertz, "Study on the Technical Aspects of Variable Use of Oil Pipelines — Coming into the EU from Third Countries", 2010

[32] www.cpc.ru/en/

[33] https://www.google.hr/search?q=Caspian+pipelines

[34] www.bp.com/en–az/caspian

[35] www.tal–oil.com/en/

[36] www.mero.cz/en/druzba/

[37] https://molgroup.info/en/

[38] http://www.total.com/en

[39] https://www.rosneft.com/

[40] https://www.eni.com

[41] http://www.lukoil.com/

[42] http://www.glencore.com/

[43] http://www.vitol.com/

[44] https://www.trafigura.com/

[45] http://www.en.transneft.ru/

[46] http://www.orlen.pl