European energy security dilemma: major challenges and confrontation strategies

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Abstract

Purpose – The purpose of this paper is to develop an integrated theoretical framework for energy security concept and to shed light on the policies and strategies applied by the European Union countries to confront the challenges that faces them.

Design/methodology/approach – The research paper uses Regional Security complexes theory, which mainly developed in Copenhagen school for security studies, that founded by Barry Buzan. This school tried to clarify the untraditional security aspects, through expanding its scope by adding new dimensions than military perspective.

Findings – Despite the consolidated efforts exerted by the European Union to assure safe levels of energy security, and their continuous pursuit to be liberated from Russian energy over dependence, but the results are still limited.

Originality/value – The value of this research paper stems from the fact that it encompass the theoretical aspect by shedding light on all the developments occurred to energy security concept, in addition to the Empirical side, by analyzing various European energy security challenges and their confrontation strategies.

Keywords European Union, Environmental sustainability, Energy security, Energy efficiency, Liquefied natural gas, Dependency rate, Reserves, Hydrocarbons, Pipelines

Paper type Research paper

1. Introduction

Energy security and the threats surrounding it is one of the most prominent matters that guide the interactions of both politicians and ruling regimes with the world. The Europeans recognized that achieving appropriate energy security levels was inevitable and could never be compromised at all, especially with the wide range of risks that faces it, for instance, the growing geopolitical threats that faces major producers, severe prices fluctuations of various energy products, supply disruptions from major suppliers due to political and other disparities, as well as destructive environmental impacts that threatens sustainability.

The growing dependence of the European Union on a limited number of energy suppliers, particularly Russia, has led to an explicit European declaration of adopting a new strategy aiming to diversify their sources of supplies, in addition to increasing reliance on

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renewable energy sources as tools to enable them to face such dominance. The Implications of European energy dependency has not been limited only to threaten their energy security status, but have been extended to undermine the European foreign policy as a whole, and that prompted a European tendency to avoid involving into sharp political differences with the Russian side so as not to affect the their energy supplies.

1.1 Main research question

This study investigates a main research question, which is:

RQ1. To what extent European policies and strategies have been able to meet the challenges of energy security?

1.2 Sub research question

To answer the previous questions, the paper intends to find answers for the following sub-questions:

Q1. What are the latest patterns in defining energy security?

Q2. What are the various dimensions that affect energy security status?

Q3. What are the main challenges that face European energy security*?*

Q4. What are the main policies that European Union has depended on to address their energy security difficulties?

1.3 Research assumptions

To accomplish the objective of this study, the research set out the following Three assumptions:

(1) A1. European policies and strategies succeeded in improving energy security status.

(2) A2. European policies and strategies failed to improve energy security status.

(3) A3. There is a limited impact of the EU policies and strategies on energy security.

1.4 Literature review

Initially, energy security concept has been tackled by various scholars, in particular, the three dimensions of availability, affordability and reliability (Desse, 1980; Yergin, 1988; APERC, 2007). Later, theoretical literature and international organizations were concerned with adding a new elements, especially, environmental acceptability (Neff, 1997; UNDP, 2000; UNDP, 2004; World Bank, 2005; Markandya *et al.*, 2005; Elkind, 2009).

There is no Common Consensus among scholars about the optimum model that can be used in analyzing the determinants of energy security in a certain state. Consequently, every scholar presented his own model and refers to the crucial components and indicators according to his point of view. Hughes (2011) framed a generic model of energy security concerned mainly with the processes that occur within the energy systems itself. Another model relies on comparing between risks and resilience of energy systems presented by Jewell and cherp (2011). Furthermore, the model which counts on differentiating between

energy security levels for each product separately proposed by International Energy Agency (2011).

Disparities continued, but at a relatively lower pace, particularly, in identifying the challenges that faces European energy security. Luft and Korin (2009) asserted that heavy dependence on imported energy resources, and limited inland production compared to other world regions is the major threats that face European energy security. On the other hand, Helen (2010) identified that reliance on limited number of supplies, especially, Russia is the main challenge. While others like Raines and Tomlinson (2016) believe that climate changes represent a vital component in redirecting the European energy counter strategy.

On the other side, some studies discussed the most prominent instruments and policies that the European Union has resorted to face these serious challenges. Fiedler (2015) claimed that the ideal confrontation strategy encompass both reinforcing integration of the internal energy market, as well as enhancing energy efficiency procedures. While, Burns (2017) emphasized on the ultimate importance of expanding reliance on renewable energy sources as a fundamental effective tool. In meantime, Leal-Arcas *et al.* (2015) argued that European confrontation mechanisms also extend to necessity of diversifying energy resources.

Generally, the theoretical literature agreed on the controversial nature of energy security concept, as it lies in an overlapping area between politics, economics, technical and environmental aspects, as well as the legal dimensions governing the circulation and energy transfer processes.

1.5 Theoretical framework and its application of EU–Russian energy relations

The research paper will depend on Regional Security complexes theory, which developed in Copenhagen school for security studies, that founded by Barry Buzan. This school tried to interpret the untraditional security concept, through expanding its scope of by adding new risks and dimensions than military traditional ones. Which are, Military Sector, Political Sector, Economic Sector, Social Sector, and Environmental Sector. (Buzan *et al.*, 1998, p. 2) Copenhagen School did not refer explicitly to energy security in separate sector, rather it mentioned implicitly to the importance of energy, and it's related issues, as it represent a vital determinant of securing other sectors. And that for several reasons, as follows:

- As long as the proponents of the school believe in the chaotic nature of the international system, so each state will try to reach a higher level of energy security.
- Securing energy resources is indirectly linked to enhancing military capabilities of the state.
- The political Security is directly linked to the ability to predict the behavior of the actors in global energy markets.
- The Environmental Security is threatened by the incompatibility between quick economic development and energy protection.

In this regard, energy security cannot be seen as direct result to threats, but for the political Interpretation of threats, so definition of security in this sense, is non-linear reaction to threats. (Belyi, 2007). Copenhagen school thinkers also put forward Regional Security complexes, which is formed from inside to outside, by the interactions between its constituent units. These security complexes characterized by the following:

- They were composed of two or more states.
- These states constituted geographically coherent grouping.

- The relationships among these states were marked by security interdependence, whether positive or negative, but which had to be significantly strong among them than any other external party.
- The Pattern of security had to be deep and durable but not permanent (Buzan *et al.*, 1998, p. 15).

By applying this Vision on energy sector, so "Regional Energy Security" is defined as "Interaction between two or more states in energy field, whether, in production, importing, exporting, and transporting of energy". Knowing that, this interaction may represent a source of threat in case of full dependence from one part on the other, like The EU's dependence on Russian gas imports which imposed a major threat to Europe not only in the energy sector, but also in various political and economic issues.

Accordingly, regional and geographic distribution of energy resources and regional energy dependence in energy security complexes can be considered parallel to distribution of military power in political and military complexes. Therefore, the possibility of a country's involvement in energy security complexes requires primarily assessing the relative strength of energy dependence by measuring a bundle of factors, including the energy trade balance, the ratio of domestic resources, as well as opportunities to diversify sources of supply (Palonkorpi, 2018, p. 3).

The structures of regional security complexes can face changes due to changing distribution of power between countries of the complex, or substituting the pattern of historical hospitality or friendship for any reason. Security systems may undergo four structural options, as follows:

(1) *Status quo*: occurs when balance of power changes and patterns of friendship and hospitality will not affect the structure of the security complex.

(2) *Internal transformation*: arise when change in power distribution, or patterns of hospitality or friendship will lead to changes in the structure of the system within the limits of the complex.

(3) *External transformation*: The external boundaries of the security complex change, as a result of new state entry into the complex or the departure of other one.

(4) *Overlay*: It is an overwhelming military superiority by a powerful state to the weak state or states, resulting in full collapse of the natural dynamics of the region's security (Buzan, 1991, pp. 215-220).

By applying Barry Buzan regional security complexs on energy relations between Russia and The European union, let us assume that we have a modern version called "Regional Energy complex structure" with the same prerequisite conditions of regional security complex of barry buzan. Which are, as follows:

- Energy complex consists of more than two countries, including the EU's 28 member states, as well as Russia.
- The energy complex in this case is geographically coherent and heterogeneous, especially, the EU countries, and the lack of direct geographical connection to Russia can be overlooked due to the presence of a large number of natural gas and oil pipelines through Ukrainian and Turkish territories.
- The relationship among the components of the complex, particularly, the European Union on one hand, and the Russian Federation on the other, is characterized by a great overlap and, mutual interdependence in the level of energy security, as a regional energy complex, where European countries rely heavily on the Russian

energy supplies equivalent to 30 per cent of their needs, also the financial revenues of Russian gas and oil exports are a key cornerstone of Russia's economy, which is a mutually beneficial partnership on both levels security and economically.

- The pattern of energy security in EU–Russia regional energy complex is deep and vital in economic and energy in particular.

Energy complexes structures also could be affected by relative changes in dependency rates, or switching to interdependence rather than dependence. These changes can go through the same four options. For example, building a new power generation unit cannot reduce dependence on external parties, and no changes are expected to happen in the regional energy system, preserving the status quo (Palonkorpi, 2018, p. 10).Despite the existence of serious European plans for investment in energy, which can contribute in changing the situation in the European–Russian energy complex, but it has not become a reality so far. It worth to be mentioned that the EU announced in 29 January 2018, various regional energy projects, including investment of EUR873m in energy infrastructure, such as, the Biscay Gulf France–Spain Interconnection, and the SuedOstLink power line, as well as constructing an internal power line between the Romanian cities Cernavoda and Stalpu. However, all these projects still under construction, which means that they still in status quo stage (Gordon-Haper, 2018).

On the other hand, internal transformations can occur if the new energy projects are large, so that changes in the dependence pattern can appear within the energy system limits (Palonkorpi, 2018, p. 10), and this could happen in case of not only Cyprus success in discovery of new gas fields beside Aphrodite, but also completion of pipeline projects to transport Cypriot gas to the rest of the European Union countries, whether through Greece or Turkey in case of settling the Cyprus problem.

External transformation can also occur in case of building large scale infrastructure strategic projects, such as constructing pipelines that can bring a huge amount of oil and gas from outside the energy complex, which will consequently lead to changing the patterns of energy dependence (Palonkorpi, 2018, p. 10). That is why the EU has set out in its options to open a negotiating track with Israel aiming to build EastMed pipeline which will be responsible for transferring Israel's hydrocarbon wealth of Leviathan gas field to Europe, which could be seen a serious attempt to acquire a new energy supplier from outside the European–Russian energy complex. This European attempts prompted Russia to intensify its negotiations with Israel to buy a significant proportion of the field to secure its energy control over Europe.

The changes can be peaked to overlaying, in case of the energy system is almost dependent on one supplier only, or one company is controlling the transfer and export of energy to the rest of the system. One obvious example is the Russian company Gazprom which has full control on transferring central Asian energy resources to Europe. In other words, the energy system will turn into a unipolar energy system instead of multipolar energy system based on interdependence (Palonkorpi, 2018, p. 10). Despite the continued European emphasis on the vital importance of Russia as a crucial partner in energy fields, however, the US involvement in liquefied natural gas (LNG) exports to Europe and its desire to double the current volumes in the coming years will probably change the energy status in the European–Russian energy complex

2. Conceptualization of energy security

Great importance of energy security concept has been fundamentally demonstrated since 1973, after Arab states oil embargo to Israel western allied countries, which led those

countries after the end of the crisis to deal with energy supplies as an issue that needs to secured. The British Prime Minister Winston Churchill is the first to recognize energy security as "diversity, nothing but diversity" (Arafa, 2014, p. 51).

A Broad Range of researchers were interested in defining the different dimensions of energy security concept. As in 1976, Willrich Manson defined energy security as "Assurance of sufficient energy supplies to permit the national economy to function in a politically acceptable manner". From this definition Willrich made a direct linkage between energy supplies and political performance of the state (Azzuni and Breyer, 2018, p. 3). Linda Miller in 1977 adopted the same definition and considered it appropriate to both industrialized and non-industrialized countries (Miller, 1977, p. 119).

By the end of 1979, David Deese defined energy security as "condition in which a nation perceives a high probability that it will have adequate energy supplies (Including traditional sources such as firewood, animal and planet wastes that is not traded in the market places) at affordable prices". According to Deese prices could be seen as affordable if it not led to severe disruption on economic and social activities. Thus, Deese emphasizes on existence of two principle components of energy security. The first is the economic component which represents all set of actions that affect quantity and reliability of domestic energy supplies. In addition to the political component that includes actions that affect external energy supplies. Deese believe that the two components are closely linked together because any problems may face domestic supplies will create more pressure on increasing imports, and that will impose more threats to national security of the state.

According to that, all actions taken by a country in pursuit its energy security may increase or decrease its independence on international arena, and will affect its security. Hence, Deese asserted that energy security is just small part from broader interaction between internal and foreign and global politics. (Desse, 1980, p. 140)

In early 1980s, Amory and Hunter Lovins emphasized that energy security is not only the ability of bringing oil, but rather is depend on other elements, especially the need to reduce dependence on oil coming from external sources. (Lovins and Lovins, 1981, p. 1)

Daniel Yergin also is one of the most important Scholars who tried to interpret the controversial concept of energy security during the 1980s, when he introduced his definition as "to Assure adequate, reliable supplies of energy at affordable prices and in ways that do not jeopardize major national values and objectives". (Yergin, 1988, p. 111) Therefore, the most important threats and risks to energy security according to yergin, are shocks, disruptions and manipulation of supplies that may lead to sudden and sharp increase in prices, that will impose more economic and political burden on the state (Yergin, 1988, p. 112).

In 1993, Douglas Bohi and Micheal Toman introduce their vision about energy security by defining its opposite, which is "The Loss of welfare because of process changes", for instance, oil prices fluctuations due to conflicts (Bohi and Toman, 1993, p. 1093).

In late 1997, Thomas Neff considered energy security as fundamental factor that affects both national and regional security. He claimed that there is a direct link between energy and environment and between changes in energy prices and fragile economics. He also refers to the crucial role that could be played by trade and cooperation in energy field in regional conflicts resolution (Neff, 1997, p. 1).

Energy security as central concept gained great momentum in the second millennium, not only from thinkers and researchers, but also from international organizations, particularly the United Nations, The International Energy agency, and The World Bank.

The United Nation Development programme (UNDP) added in 2000 new elements to energy security not only linked to availability and prices, but also energy access to various

consumers, negative environmental impacts on the ecological system result from gas emissions, as well as health problems due to increase energy use (UNDP, 2000, p. 4).

In the following year 2001, The International Energy Agency (IEA) defined energy security as "The uninterrupted availability of energy sources at an affordable price and examines it in the short and long terms". In short–term through the ability to deal with sudden changes in the supply demand balance, while in long-term by focusing on continuity of investing in energy for the sake of fulfilling economic and environmental development requirements (Kocaslan, 2014, p. 726). Jansuz Bielecki in 2002 also supported this vision by defining energy security as "providing adequate and reliable supplies of energy consistently meeting the demand of global economy at affordable price" (Tufail *et al.*, 2018, p. 2).

The United development Programme asserted on the great importance of environmental concerns in energy security, and that through the definition which was presented by the programme in 2004, stating that "it is the availability of energy at all times in various forms, in sufficient quantities, and at affordable prices, without unacceptable or irreversible impact on the environment" (UNDP, 2004, p. 42).

The world bank experts group also addressed a definition of energy security in 2005, which is "ensuring countries can sustainably produce and use energy at reasonable cost to facilitate economic growth, as well as improving the quality of people life by broading access to modern energy service". However, in spite of this comprehensive definition, the precise definition of the concept according to the Bank's experts varies from state to another based on three sets of criteria: the level of economic development, the volume of available energy resources and the potential impact of global energy demand (World Bank, 2005, p. 3).

In this regard, countries according to world bank composed into five categories differs according to the three previous variables, as follows:

(1) *Industrilizied Net Energy Importers*: The priorities of energy security for this category including avoiding supply disruptions, diversification of energy resources, security concerns related to energy infrastructure and its protection, as well as using technology to minimize dependence on external energy supplies.

(2) *Major Hydrocarbons Exporting Countries*: It's main energy security concerns ensuring long-term markets with affordable prices, diversifying energy exports markets, and securing finance for investing in energy sector.

(3) *Large emerging markets with rapidly growing energy demand*: Its energy security requires the ability to meet the growth of energy demand from external sources, securing the capital needed to invest in the resources and infrastructure, and using technical solutions to reduce dependence on imported energy sources, as well as meeting the basic energy needs of their citizens.

(4) *The fourth and fifth categories, represented in Mid and Low -income energy importers*: Both of them share the same energy security priorities, including the ability to meet energy demand from external sources, diversification of supply sources, securing financial resources for investment in development and energy infrastructure, as well as resorting to modern technologies to reduce dependence on external supplies, as well as the continuous pursuit to meet the basic energy needs of the citizens.

Therefore, it worth to be mentioned that the World Bank vision about energy security is linked directly to time factor. Accordingly, the bank differentiated between energy security requirements on both long and short terms. Energy security requirements on long term represented in the ability to fulfill energy growing demand, for instance, ensuring long-term

oil supply and maximizing the capacity of absorbing carbon emissions. On the other hand, short-term energy requirements include the ability of the state to deal with negative economic and market impacts due to oil price fluctuations (World Bank, 2005, p. 3).

In the same year, a group of scholars, led by Anil Markandya, presented four new elements could be disrupted in case of energy security is threatened. Physical Disruption, occurs due to exhaustion or stopping of energy production, either temporary or permanently. Economic Disruption, happens as result of severe prices fluctuations in international markets. Social Disruption may occur in case of instability of energy supplies. Environmental Disruption, which takes place due to damage in the eco system caused by energy chains, whether unintentionally through, for instance, oil slicks or nuclear accidents, or as result of polluting emissions, like greenhouse gases. They also took into account time factor, as they clarify that energy security could be seen from two perspectives. In the Short-term Energy security, the main concern is the disruptive impact of an unanticipated cut in supply or rise in price. While, in long-term it focuses on the availability of energy supplies for economic and sustainable development (Markandya *et al.*, 2005, p. 3).

The role of government was the new factor which has been added to the energy security by Larry Hughes in 2006. As he define energy security as "The Governmental actions and policies to ensure access to safe, reliable and affordable energy sources for the community" (Hughes, 2006, p. 3).

Despite Daniel Yergin's acceptance of defining energy security as "Ensuring adequate supplies of energy at affordable and reasonable prices". However, he asserted that global practices had revealed that each state interpreted the concept differently based on their views, and in a way that serve their own interests. As for energy exporting countries, focus mainly on "Security of Demand" for their exports, because its governmental revenues depend intensely on it, and that demonstrated clearly in the Russian case. The Russians have set out to control the strategic resources, whether the energy resources itself, or the energy infrastructures, such as pipelines or water paths that is used by hydrocarbon ships to reach the various global markets.

On the other hand, the main energy concern for developing countries related directly to price fluctuations that may affect their balance of payments negatively. While other countries like India and china believe that securing energy derives from the ability to adapt quickly to global markets, which is quite different from their previous approach depending on self-sufficiency and self-reliance (Yergin, 2006, p. 71).

One of the most comprehensive leading efforts in interpreting the concept of energy security goes back to Asia-Pacific Energy Research Center in 2007, as it defined energy security in their published report as "The ability of an economy to guarantee the availability of energy resource supply in a sustainable and timely manner with the energy price being at a level that will not adversely affect the economic performance of the economy". According to this definition, there are five factors that affects energy supply security, as follows:

(1) Availability of adequate fuel reserves from both domestic and external sources.

(2) The ability of an economy to attract supply to meet the expected demand for energy.

(3) The level of an economy's energy resource diversification and energy supplier diversification.

(4) Accessibility to fuel resources, through other availability of energy infrastructure and energy transportation infrastructure.

(5) The geopolitical concerns related to resources acquisition process (APERC, 2007, p. 6).

Jonathan Elkind represent a leading thinker who has been interested in adding new dimensions for energy security in 2010, especially environmental sustainability to the already existing three dimensions which are availability, reliability, and affordability. From this perspective, Elkind refers to the essential components of environmental sustainability, which are:

(1) reducing greenhouse gases (GHG) emissions;

(2) contribution of local, regional and global systems to the preservation of environmental quality; and

(3) protecting ecosystems from climate changes impacts.

He also highlighted the major potential environmental threats to energy security, which are:

- policies resulted from the narrow definition of energy security, such as supporting the use of coal; and
- negative impacts of climate changes, especially, rise of the sea level and destructive climate events (Elkind, 2009, p. 121).

By 2011, Ditya Nurdianto and Budy Rosousdarmo have once again returned to emphasize that energy security based on two key concepts: availability and pricing. As for importing countries, the essence of energy security is "securing sources of supplies" in terms of quantities and expected prices. While the core of energy security for exporting countries is the availability of energy at all times in sufficient quantities and at reasonable prices (Nurdianto and Rosousdarmo, 2011, p. 106). However, 2013 witnessed the simplest energy security definition ever, presented by a group of scholars, led by Lidija Cehuli, which is "The freedom of energy supplies from disruption or interruption, whatever the reasons" (Cehulic *et al.*, 2013, p. 130).

Energy security concept definition was drastically changed in 2014, as the emphasis is no longer on security of supply, but security of demand. Benjamin Sovacool and others scholars defined it as "Equitable providing of available, affordable, reliable, efficient, environmentally benign, proactively governed, and socially acceptable energy services to end users" (Sovacool *et al.*, 2014, p. 11).

Furthermore, the central definition to energy security was presented by Jessica Jewell, Aleh cherp and other scholars in the same year. According to them energy security is "Low vulnerability of vital energy systems". They also defined Virtal energy system as "Those energy systems such as energy resources, technologies and uses linked together by energy flows, which are essential to support critical societal functions". While vulnerabilities vital energy systems are "combinations of their exposure to risks and their resilience or ability to respond to disruptions" (Jewell *et al.*, 2014, p. 5).

This idea is directly connected to the three perspectives of energy security which are being presented before by Aleh cherp. Sovereignty, goes back to political science, international relations and strategic security studies. Robustness, find its roots in engineering and natural science. While, resilience, mainly linked to economics (Jewell and cherp, 2011, p. 6):

(1) *Sovereignty perspective*: Focuses mainly on risks and threats imposed by external factors, whether hostile states, terrorist organizations and groups, unreliable exporters, foreign energy companies with extensive influences and great powers. The main threats arise according to this perspective from embargoes, acts of sabotage or terrorism. According to this perspective risk minimization strategies demonstrated in shifting to more trusted suppliers, weakening the role of the single

supplier by applying diversification of suppliers strategy, substituting the imported resources with domestic ones, as well as casting military, political and economic control over regional and global energy systems.

(2) *Robustness perspective*: Energy security threats according to this perspective are seen as objective could be count or measured, for instance, demand increase, resources scarcity, ageing of infrastructure, technical failure, destructive natural events. Minimizing risks of this disruptions could happen through upgrading energy infrastructures, substituting energy resources with more available ones, using safer technologies, in addition to managing energy growth more efficiently.

(3) *Resilience perspective*: Realizes the future as fundamentally unpredictable and uncontrollable due to high complexity, uncertainty and non-linearity of energy systems, markets, technologies and societies. Hence, risks and threats also unpredictable it could be regulatory changes, economic fluctuations, political regimes change, technological booming, climate changes. And for that reason, this perspective does not focus on minimizing such inherently uncertain risks, rather it searches for more generic characteristics of energy systems like flexibility, adaptability, diversity that ensure protection against any threats by spreading risks and preparing for surprises (Jewell and cherp, 2011, pp. 7-8).

Generally, after reviewing all these wide range of the energy security definitions, the most acceptable one is "Availability of adequate production of energy sources at affordable prices". This definition focuses on the supply side. However, concept could be interpreted differently according to each country (Arafa, 2014, p. 53).

3. European energy security status

European energy security has become highly threatened, especially after several international estimates that indicate a general trend of rising European dependence on external energy sources. The European Union imports more than half of its energy consumption. Its import dependency is higher for crude oil (90 per cent) and natural gas (66 per cent), and to a lesser extent solid fuels (42 per cent) as well as nuclear fuel (40 per cent), with total daily import bill more than 1 billion Euros (European commission, 2014a). One of those revealed that by 2030, Europe will depend mostly on imported energy reaching 70 per cent of dependency rate, taking into account that EU enlargement will not offer any effective solution for this dilemma (Kuik, 2003, p. 225).

3.1 European energy security challenges

There are many challenges that faces European energy security, including those related to their energy production capacities, and the size of their reserves, as well as those related to environmental concerns resulting from energy systems, they are, as follows:

3.1.1 Low contribution of European Union countries in proven reserves and global production. European countries, including non-EU members, contribute with very small amount in hydrocarbons proven reserves. In terms of natural gas reserves, by the end of 2017 European countries contribution amounted 104.5 TCF, equivalent to only (1.5 per cent), compared to Russia (18.1 per cent), Qatar (12.9 per cent) and USA (4.5 per cent) of global natural gas reserves (British Petroleum, 2018, p. 26). With regard to European crude oil reserves, it reached 1.7 thousand million tons, equivalent to (0.8 per cent), compared with the Venezuela (17.9 per cent), Saudi Arabia (15.7 per cent), Canada (10 per cent), Iran (9.3 per

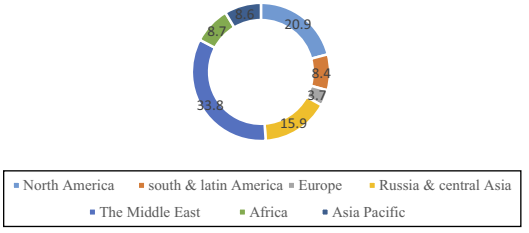
cent), Iraqi (8.8 per cent), Russia)6.3 per cent), Kuwait (6 per cent) and the USA with only (2.9 per cent) of the total world reserves (British Petroleum, 2018, p. 12) (Figure 1).

The European continent is the least contributor of all the world regions in global energy production equation. In 2017, the European oil production was only 162.6 million Tones, compared to the Middle East which ranked first 1481.1 million tons, then North America by 916.8 million tons, followed by Russia and Central Asia at 699.6. Million tons, then Africa with 383.3 million tons, while Asia and Latin America produced 375.5 and 368.3 million tons respectively (British Petroleum, 2018, p. 16).

In terms of Natural gas production, Europe ranked the fifth between world regions by 241.9 BCM, after North America with total production reaching 951.5 BCM, Russia and central Asia with 815.5 BCM, The Middle East 659.9 BCM, and Asia pacific 607.5 BCM. Then in sixth rank after Europe, Latin America and Africa with total production 225 and 179 BCM, respectively (British Petroleum, 2018, p. 28) (Figure 2).

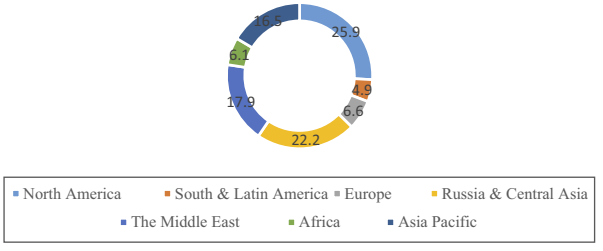
3.1.2 The wide gap between domestic production and consumption. The year 2017 witnessed a considerable variation between the amount of domestically produced oil and gas from ones side, and what is already consumed from other side. In terms of crude oil, European Union produced only 162 million tons (British petroleum, 2018, p. 16) While the consumption amounted about 731.2 million tons (British petroleum, 2018, p. 17). Meaning that domestic production did not exceed 22.2 per cent of total consumption (Figure 3).

In more slightly better situation, European Union natural gas production reached 241.9BCM (British Petroleum, 2018, p. 28), while the consumption also increased amounting around 531.7BCM (British Petroleum, 2018, p. 29). Which means that the domestically



Source: Own elaboration based on British Petroleum, 2018 Statistical Review 2018

Figure 1.
Oil production percentage per region in 2017



Source: Own elaboration based on British Petroleum, 2018 Statistical Review 2018

Figure 2.
Natural gas production per region in 2017

produced European natural gas covers less than 46 per cent of internal consumption (Figure 4).

3.1.3 Depending on limited number of suppliers. In 2016, European Union Countries imported more than) 82 per cent (of their natural gas from four countries only, which are Russia (40.2 per cent), Norway (24.9 per cent), Algeria (12.1 per cent), Qatar (5.5 per cent), while (17.3 per cent) from their imports from the rest of the world (Eurostat, 2017) knowing that Baltic countries, Finland, Slovakia and Bulgaria depend only on one supplier, while other countries like Czech Republic and Austria depend on very limited suppliers almost two (European Commission, 2014b, p. 8). In 2016, Hungary imported around (89 per cent) of its annual natural gas consumption from Russia, the Czech Republic (99 per cent), and Slovakia (95 per cent) (Burns, 2017). With regard to oil, More than two-third of European imports are only from five countries: Russia (32 per cent), Norway (12 per cent) and nearly (8 per cent) for Saudi Arabia, Nigeria and Kazakhstan (7 per cent) for each one. While more than three-quarters of its solid fuels imports, particularly coal, come from three countries: Russia (30 per cent), Colombia (23 per cent) and Australia (15 per cent). And that constitutes a real threat in case of any disruption may happened of these supplies, whether through intended actions by the authorities of those States, or unintentional as a result of technical failures or environmental problems or otherwise (Eurostat, 2017).

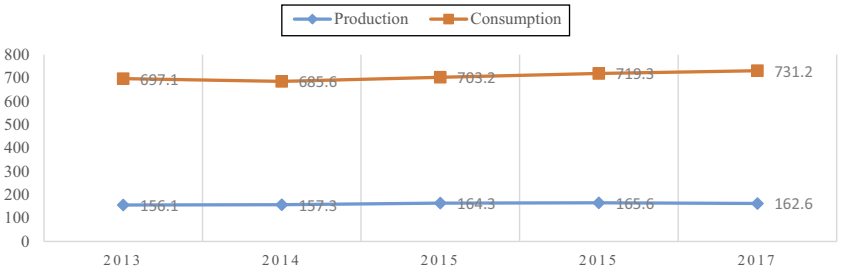


Figure 3.
European oil production and consumption (2013-2017)/Million Tones

Source: Own elaboration based on British Petroleum, 2018 Statistical Review 2018

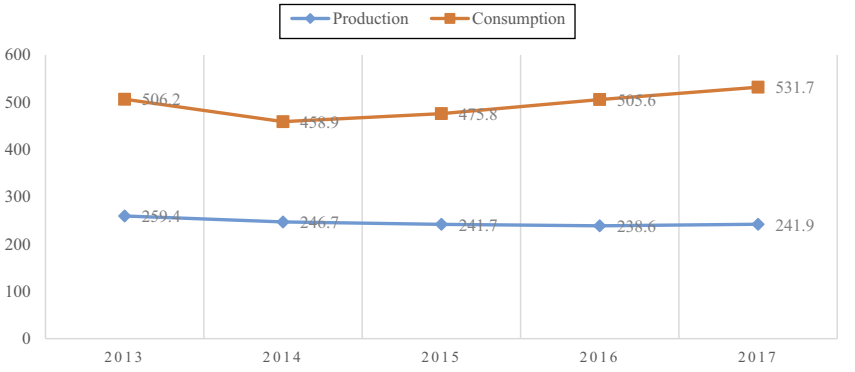


Figure 4.
European natural gas production and consumption (2013-2017)/billion cubic meters

Source: Own elaboration based on British Petroleum, 2018 Statistical Review 2018

3.1.4 Environmental concerns due to heavy use of polluting energy resources. The processes of exploring, producing and transporting energy resources, particularly fossil fuel, contribute heavily in polluting the universe. According to international energy estimates for 2009, energy sector contributed with about (84 per cent) of carbon dioxide emissions, and nearly (64 per cent) of greenhouse gases. These amounts are expected to increase by 2020 to (91 per cent) of global carbon dioxide emissions, and (71 per cent) of greenhouse gases (UNDP, 2012, pp. 25-26).

In 2017, European consumption from oil reached (731.2) million tones oil equivalent, and (457.2) million tones oil equivalent for natural gas consumption, while coal consumption amounted (296.4) million tones oil equivalent. These amounts constituted together around 75.4 per cent of total European energy consumption (British Petroleum, 2018, p. 9), which could be considered huge percentage that affects environment negatively (Figure 5).

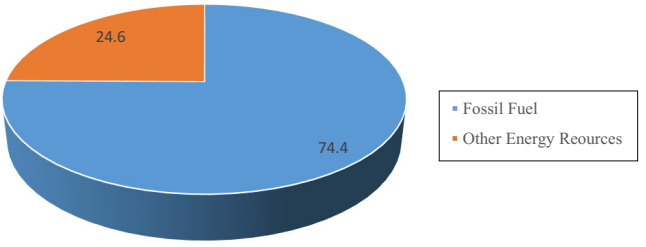
Coal is the most environmentally polluting hydrocarbons, and despite the low dependence of European countries on coal as one of the sources of power generation, it is still exist within their consumption equation. The European continent is the third largest coal user in the world by (8 per cent), after Asia in the first place, which accounts (74 per cent) and North America using around (10 per cent) of global use of coal (British Petroleum, 2018, p. 9).

4. European confrontation strategies

European officials did not hide their desire to face these challenges, especially, liberating themselves from Russian Overdependence, that threaten their independence on both political and economic level, and hinder their political freedom, particularly, after 2009 crisis when rows over unpaid gas bills between Kiev and Moscow led to supplies disruptions to western Europe (Lewis and Emmott, 2014). Accordingly, European countries applied a counter strategy to reduces the effects of that total dependence on Russia energy resource, which includes, the following:

4.1 Intensify reliance on renewable energy resources

The Europeans found that expanding the use of renewable energy resources is one of the best options to reduce dependence on external suppliers, particularly Russia. Hence, they took several steps to achieve this goal, for instance, in 23 April 2009, the European Parliament and the Council has announced the issue of the renewable energy directive



Source: Own elaboration based on British Petroleum, 2018 Statistical Review 2018

Figure 5.
EU's primary energy consumption mix in 2017 (%)

known as (RED) which aims to increase the proportion of renewable energy resources to 20 per cent of the total consumption by 2020 (European Commission, 2009a).

It worth to be mentioned that by end of 2017, renewable energy overall share in Europe reached (17 per cent) of total consumption. This percentage varies between countries as it constituted the highest in Sweden (53.8 per cent), and Finland (38.7 per cent). At the opposite scale the least proportions (6 per cent) and (5.4 per cent) for The Netherlands and Luxembourg, respectively (Eurostat, 2018) (Figure 6).

These developments pushed the European Union to take further steps on the same way, which resulted in the European Commission's approval on 14 June 2018 on new binding package called Renewable Energy Directive 2 (RED II), that seeks to achieve a binding renewable energy target for the EU for 2030 of 32 per cent, including a review clause by 2023 for an upward revision of the EU level target (European Commission, 2018a, 2018b).

In terms of renewable energy investments, Europe ranked second in the world in 2017 after China and, before the USA, where the value of their investments reached $40.9bn, which is equivalent to (14.62 per cent) of global investment. (Frankfurt School of Finance and Management gGmbH, 2018, p. 14) This value is divided between different renewable energy sources, solar energy accounted for $10.8bn, wind $28bn, biofuels $0.6bn, geothermal energy $0.2bn, Biomass $1bn, small hydro $0.2bn and, finally Marine $0.1bn (Frankfurt School of Finance and Management gGmbH, 2018, p. 24) (Table I).

These efforts materialized significantly in the increasing proportion of renewable energy in the overall European electricity consumption, which started in 2010 by (20.4 per cent), then increased slightly reaching (20.7 per cent) in the following year 2012, this proportion gradually increased accounting (23.6 per cent). After increasing significantly in 2014 and 2015 constituting (28.5 per cent) and (29.8 per cent), respectively, before peaking in 2017 accounting around (30 per cent) of total European electricity consumption (Agora Energiwnede and Sandbag, 2018, p. 11) (Figure 7).

4.2 Securing new energy suppliers

In recent years, the EU has begun to move forward seeking new suppliers, without abandoning traditional ones. Norway was the non EU member state who played this role. In 2017, European Union Imports from Norway's natural gas reached 114 BCM which represent around (23.4 per cent) of its imports. (British Petroleum, 2018, p. 34) It is true that

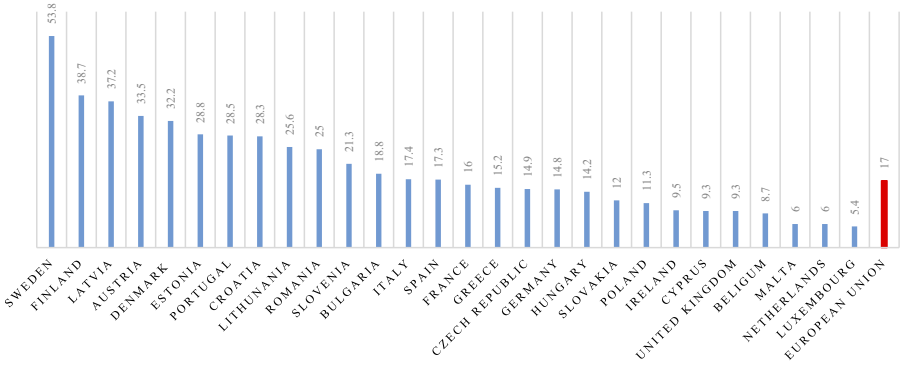


Figure 6.
Share of energy from renewable resources in the EU member state (in % of gross final consumption

Source: Eurostat, 2018

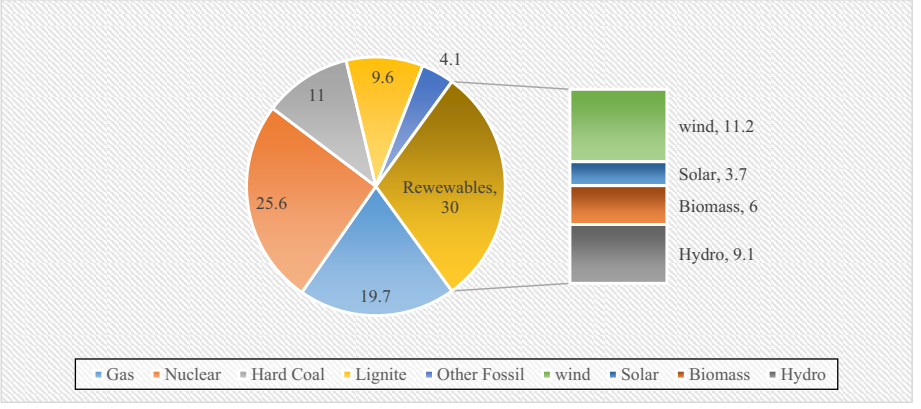
this ratio is still relatively low when compared to other suppliers especially Russia, but at the same, it time expresses the EU tendency to reduce dependence on Russian gas (Table II).

European Union attempts is not limited to European continent borders, rather it extend to the south, particularly east Mediterranean region. The huge wealth of hydrocarbons which has been discovered during the last decade pushed them to realize that this could an opportunity to secure themselves, and to be relatively free from Russian dominance, but the

Rank	Country	Investments in $bn (2017)
1	Germany	10.4
2	UK	7.6
3	Sweden	3.7
4	France	2.6
5	Turkey	2.2
6	The Netherlands	1.8
7	Italy	1.7
8	Norway	1.4
9	Ireland	0.8
10	Greece	0.8

Source: UN Environment, Bloomberg New Energy Finance (Frankfurt School of Finance and Management gGmbH, 2018)

Table I. Top ten European countries in renewable investments in 2017/$bn



Source: Eurostat data, 2017

Figure 7. European electricity generation mix in 2017 (%)

European natural gas imports by source	Pipeline (%)	LNG (%)	Total (%)
Natural gas Imports from Norway (BCM)	109.4	4.8	114.1
Total Natural gas Imports(BCM)	423.4	65.7	489.1
	25.8	7.3	23.4

Source: Own elaboration based on data of British Petroleum, 2018 Statistical review 2018

Table II. European imports of natural gas from Norway according to their type in 2017/ billion cubic meters

main obstacle that faces them was the lack of infrastructures, in particular, offshore pipelines that is responsible to carry region's natural gas to their land. In this regard, the European Union supported enthusiastically the common natural gas infrastructure projects in the east Mediterranean, especially "EastMed" pipeline (ElBassoussy, 2018, p. 78).

The EU approved in 2015 the "EastMed" as being a project of common interest, considering it as part of southern Gas Corridor Projects, as well as listing the project in the last Ten Years Development Plan "TYNDP" in coordination with European Network Transportation System Operators of Gas "ENTSOG" to create a consolidated gas market and a transportation network capable of fulfilling Europe's current and future needs (IGI Poseidon, 2018). In addition to taking part in financing the initial feasibility studies of the project. During the period from 2015 to 2016, IGI Poseidon Company conducted Pree-FEED Studies at $4m, where the EU contributed with $2m that equals (50 per cent) of the total cost of the study, reflecting the great importance of this project for the Europeans (Margheri, 2017, p. 3).

At the same time, The European companies, especially British Petroleum and Eni, put more investments in the Eastern Mediterranean gas fields, particularly in Egypt, which resulted in the discovery of several fields such as Zohr, which is the largest field in terms of reserves (The Guardian, 2015), as well as a number of other fields that contain relatively less reserves, as well as entering into ongoing negotiations with the Israeli side to deliver the huge Leviathan gas field to Europe via the pipeline that is being negotiated with Cyprus, Greece and Italy (The Times of Israel, 2018). These huge discoveries expected to contribute partially in securing European energy status, and that made Russia slightly worried, and push it to buy shares in these newly discovered fields to ensure its control on European energy security (Politi and Farchy, 2016).

The USA also seems to be an important player in the identification of European energy security, after being a competitor to Russia in European energy imports, particularly in terms of liquefied natural gas. Europe is now the top buyer of US liquefied natural gas (LNG) after a near fivefold spike in US LNG sales to the continent this winter, overtaking South Korea and Mexico (Kravtsova and Zawadzki, 2019). On 25 July 2018, on the margins of a meeting with European Commission President Jean-Claude Juncker, President Trump announced that the European Union (EU) will soon be a "massive buyer" of US liquefied natural gas (LNG), in what was perceived as an attempt to ease trade tensions with transatlantic allies. This declaration boosted stocks of US LNG exporters, and which was welcomed by several high-ranking EU officials, with German Economy Minister Peter Altmaier hailing it as a "breakthrough" (Kabouche, 2018).

Thus, the European energy security status has become less threatening after the United States entered the European markets as a major competitor of Russian Liquefied gas, which will not only reflect on energy, but also on other political aspects, as it will free The EU from full dependence on Russia from side and will bring it closer to the USA from the other side, and that consequently will strengthen its position on the international arena, especially in the against Russia, which will be directly in the interest of USA.

Generally, the availability of new energy supplies to the EU Whether from East Mediterranean Basin or US LNG Exports will contribute partially in preserving European energy status, knowing that the Russian exports remain crucial for the Union, and that requires from the Europeans be careful of not losing Russia at least in the current stage until the completion of the feasibility study for the transfer of the Mediterranean gas to Europe, as well as knowing the maximum capacity that US can provide to European and whether it will fulfill their needs.

4.3 Stockpiling as a tool to confront potential supplies disruptions

On 14 September 2009, The European commission adopted The "EU's Oil Stocks Directive", which includes: maintaining emergency oil or petroleum stocks for not less than 90 days of net imports, or consumption for 61 days at least, which is higher for Eu countries. These stocks must be ready to be used in case of a crisis. In addition to putting obligation on each country to provide a statistical summary for its oil stocks by the end of each month, encompass the number of days of net imports or consumption. It also gave the European commission the authority to organize a consultation between the EU members in times of supply crisis and that will done through a standing advisory group known as "the oil coordination Group" (European Commission, 2009b).

On 19 October 2018, The European commission announced launching the amending council directive of oil stock, which amended some points related defining to the oil stock, and methods of calculations (European Commission, 2018a).

The European Union countries have achieved equal or higher rates than those which is agreed upon in the Directive. In August 2018, Finland was in the lead with a stock of 160 days of consumption, followed by Greece for 134 days and Malta for 123 days. While the lowest was the UK with only 60 days of oil stocks (Eurostat, 2019) (Figure 8).

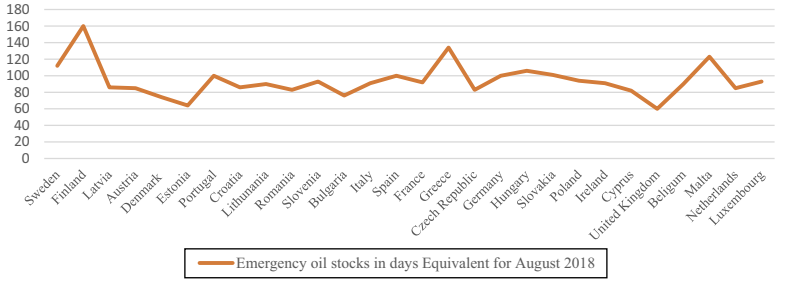
4.4 Applying rational energy consumption policies

The EU realized that internal efforts could be an effective solution in reducing energy dependence. Thus, in 25 october 2012, The European Union has set a target of 20 per cent energy savings by 2020, which is approximately equivalent to shutting down around 400 power stations, through what is known as "Energy Efficiency Directive" (European Commission, 2012).

On 30 November 2016, the European Commission provides a new proposal encompass a new target to reach 30 per cent energy savings by 2030. Furthermore, applying new measures to be sure that the amended target has been achieved (European Commission, 2016).

A further step has been taken by the Commission, the Council, and the European Parliament as they reached a new agreement on 14 June 2018, that includes a new energy saving level for the European Union countries of 32.5 per cent by 2030 (European Commission, 2018b).

These legislative and procedural efforts have resulted in a significant reduction in energy use in the EU. Final energy consumption has fallen in all member states since 2005 except in Lithuania, Malta and Poland Compared to 2014. While in 2015, Final energy consumption rose in all except five countries, with the largest reductions in Latvia (−2.5 per cent), Estonia



Source: Eurostat, 2019

Figure 8.
Emergency oil stocks in days equivalent for August 2018

(−1.8 per cent) and Finland (−1.3 per cent). In mean time, the highest increases were in Hungary (6.9 per cent), Greece (6.3 per cent) and Croatia (5.5 per cent).

On the other hand, primary energy consumption has fallen in all member states since 2005 except in Estonia and Poland. However, in 2015 primary energy consumption increased in most countries compared to the previous year, with highest increases in Hungary (5.9 per cent), Portugal (4.9 per cent) and Ireland (4.6 per cent). Malta reported the highest decrease (−14.9 per cent), followed by Estonia (−6.3 per cent) and Sweden (−5.5 per cent). It worth to be mentioned that, although energy consumption increased by 1.5 per cent in 2015, it was still on the right track to meet the entailed target (European Commission, 2017).

4.5 Reducing environmental harmful emissions

Due to the closed link between energy security and environmental concerns, European Union exerted intensified efforts to reduce the Green House Gases emissions, which are the major responsible for climate changes. Total GHG emissions in the EU decreased by (1279 Mt CO2e) in 2016, representing a reduction of 22.4 per cent compared with 1990. The reduction amounts to 24 per cent (1358 Mt CO2e) if emissions from international aviation are excluded. This reduction can be justified through the growing use of renewable energy sources, using less carbon intensive fuel, as well as improving energy efficiency. Knowing that, The UK and Spain accounted the largest decrease, while there was a relatively large increase in Poland (European Environment Agency, 2018).

5. Factors affecting European energy policies to secure their energy shortage

Several factors contribute in success or failure of European policies and arrangements in securing acceptable levels of energy security, they are, as follows:

5.1 The accelerated pace of competition between the major international powers exporting energy resource to Europe especially between the USA and Russia

The American LNG is slightly cheaper as its prices are indexed to the US Henry Hub gas spot price, while Gazprom's prices are indexed to the price of crude oil. In addition to the flexibility of US LNG Contracts, which includes tolling agreements, which guarantee the right of reservation of liquefied capacity for a fixed rate for periods of 15-20 year on a use-or-pay basis. The Implication of this demonstrated clearly in the statistics of the US Department of Energy, revealed that between February 2016 and May 2018, Europe received around 11 per cent of US LNG (Kabouche, 2018).

5.2 Political stability or instability in transit countries

The European Union receives about 30 per cent of the energy resources from Russia across the Ukrainian territory. Thus, the differences and political strife between Russia and Ukrainian government supported by the USA boosts a situation of political instability that can negatively affect the security of its Russian energy needs, so it is a priority for Europe to have a relatively political stable environment in Ukraine. One Important example for that appeared in April 2014, when The Russian President Vladimir Putin declared in an open letter to European leaders that Europe faces an increasing risk of a new gas supply crisis a result of the Ukrainian conflict (Umbach, 2014).

5.3 Fluctuations of energy prices

The majority of European energy sources are imported from abroad, and therefore, the continuous fluctuations and price increases directly affect the economic situation. The

European energy import bill in 2017 reached EUR 266bn, a rise of 26 per cent compared to 2016, but at the same time less than 2013 peak of EUR 400bn, knowing that the main reason behind that is the rising price of oil products. Accordingly, deducting these huge financial amounts from domestic budgets negatively affects economic growth rates in some European countries (European Commission, 2019, p. 7).

6. Conclusion

Despite the European realization that their energy security will remain threatened as long as their energy supplies rely mainly on Russia. Which motivated them to look for new instruments to liberate themselves from such over dependency. The expansion of reliance on renewable energy technology, searching for new suppliers as part of diversification of supplier's strategy to ensure uninterrupted energy supplies, provisioning relatively high levels of hydrocarbon energy stocks, finding new ways to reduce polluting environmental harmful emissions, as well as applying comprehensive energy reduction policies through both energy conservation and efficiency of use. Nevertheless, the impact of these instruments remains limited, as the European dependence on Russian energy sources has not been reduced to the entailed level.

However, the possibility of improving the European energy security status is still relatively possible, that simply because the European strategy is characterized by high level of integration. In other words, it is wide-ranging in terms of covered issues to include both provision of resources and environmental sustainability. It also going at all levels, whether legislative or executive, and subject to ongoing monitoring and reviewing processes to find out their shortcomings and strive to overcome them. In addition to the great attention of all major European Union institutions, especially the Commission, the Parliament and the Council of the European Union to it.

References

Agora Energiwnede and Sandbag (2018), "The European power sector in 2017. State of affairs and review of current developments", available at: https://sandbag.org.uk/wp-content/uploads/2018/01/EU-power-sector-report-2017.pdf (accessed on 10 January 2019).

APERC (2007), *A Quest for Energy Security in the 21st Century: Resources and Constraints*, Asia Pacific Energy Research Center, Japan, available at: https://aperc.ieej.or.jp/file/2010/9/26/APERC_2007_A_Quest_for_Energy_Security.pdf (accessed 10 November 2018).

Arafa, K. (2014), *Energy Security and Its Strategic Implications*, 1st ed., Naif Arab University for Security Sciences, Center for Studies and Research, Riyadh.

Azzuni, A. and Breyer, C. (2018), "Definitions and dimension of energy security: a literature review", *Wiley Interdisciplinary Reviews: Energy and Environment*, Vol. 7 No. 1.

Belyi, V. (2007), *Energy Security in International Relations (IR) Theories, Cathedra on Political Issues of International Energy*, Higher School of Economics.

Bohi, D. and Toman, M. (1993), "Energy security: externalities and policies", *Energy Policy*, Vol. 21 No. 11.

British Petroleum (2018), "BP statistical review of world energy june 2018", Energy Outlook, London, available at: www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-full-report.pdf (accessed 10 July 2018).

Burns, J. (2017), "Pulling the plug on Europe's energy dependence", The American century project, available at: www.americansecurityproject.org/pulling-the-plug-on-europes-energy-dependence/ (accessed 7 January 2019).

Buzan, B. (1991), *States and Fear: An Agenda for International Security Studies in the Post-Cold War Era*, 2nd ed., Harvester Wheat sheafm, Hertfordshire.

Buzan, B., Waever, O. and de Wilde, J. (1998), *Security: A New Framework of Analysis*, 1st ed., Lynne Rienner publisher, CO.

Cehulic, L., Kuznetsov, A., Celikpala, M. and Gleason, G. (2013), "Energy security in South East Europe", in Cross, S., Kentera, S., Nation, C. and Vukadinović, R. (Eds), *Shaping South East Europe s Security Community for the Twenty-First Century: Trust, Partnership, Integration*, 1st ed., Palgrave Macmillan, London.

Desse, D. (1980), "Economics, politics, and security", *International Security*, Vol. 4 No. 3.

ElBassoussy, A. (2018), "East mediterranean gas: a new arena for international rivalry", *Review of Economics and Political Science*, Vol. 3 No. 2.

Elkind, J. (2009), "Energy security call for broader agenda", in Pascual, C. and Elkind, J. (Eds), *Energy Security: Economics, Politics, Strategies, and Implications*, 1st ed., Brookings Institution Press, Washington, DC.

European Commission (2009a), "Directive 2009/28/EC of the European parliament and of the council of 23 April 2009", available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32009L0028 (accesssed 16 December 2017).

European Commission (2009b), "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", available at: https://eur-lex.europa.eu/legal-content/EN/ALL/;jsessionid=0g1BTRSFG7fv1TNKJvrNFLqnrfYl5nLWpxHSXp6gpK5JvvN9v516!2097610408?uri=CELEX%3A32009L0119 (accessed 18 December 2017).

European Commission (2012), "Directive 2012/27/EU of the European parliament and of the council of 25 October 2012", available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1399375464230&uri=CELEX:32012L0027 (accessed 7 December 2019).

European Commission (2014a), "Communication from the commission to the European parliament and the council European energy security strategy Swd330 final", available at: https://www.eesc.europa.eu/resources/docs/european-energy-security-strategy.pdf (accessed April 2016).

European Commission (2014b), "Commission staff working document in-depth study of European energy security", available at: https://ec.europa.eu/energy/sites/ener/files/documents/20140528_energy_security_study.pdf (accessed 5 June 2016).

European Commission (2016), "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, 860 final", available at: https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans (accessed 6 November 2018).

European Commission (2017), "Report from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions renewable energy progress report com/2017/57final", available at: https://ec.europa.eu/transparency/regdoc/rep/1/2017/EN/COM-2017-57-F1-EN-MAIN-PART-1.PDF (accessed on 24 January 2019).

European Commission (2018a), "Commission implementing directive (Eu) 2018/1581 of 19 October 2018 amending council directive 2009/119/Ec as regards the methods for calculating stockholding obligations", available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1581&from=EN (accessed 20 November 2018).

European Commission (2018b), "Energy efficiency first: commission welcomes agreement on energy efficiency", available at: http://europa.eu/rapid/press-release_STATEMENT-18-3997_en.htm (accessed 19 November 2018)

European Commission (2019), "Energy prices and costs in Europe", available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1548155579433&uri=CELEX:52019DC0001 (accessed 11 June 2019).

European Environment Agency (2018), "Trends and drivers in greenhouse gas emissions in the EU in 2016", available at: www.eea.europa.eu/publications/trends-and-drivers-in-greenhouse (accessed 15 January 2019).

Eurostat (2017), "Energy overview", available at: https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html (accessed on 7 January 2019).

Eurostat (2018), "Renewable energy statistics", available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics#Renewable_energy_produced_in_the_EU_increased_by_two_thirds_in_2006-2016 (accessed 10 January 2019).

Eurostat (2019), "Oil stocks-emergency stocks in days equivalent-monthly data", available at: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_143m&lang=en (accessed 12 January 2019)

Fiedler, M. (2015), "The energy union: what¨s behind it?", Policy Paper, ROSA LUXMBURG STIFTUNG, Brussels, available at: https://de.rosalux.eu/fileadmin/user_upload/energy-union-what-is-behind-it-2015.pdf (accessed 2 February 2019).

Frankfurt School of Finance and Management gGmbH (2018), "Global trends in renewable energy investment 2018", Frankfurt, available at: www.iberglobal.com/files/2018/renewable_trends.pdf (accessed 20 January 2019).

Gordon-Haper, G. (2018), "European union announces collaborative energy projects", International Institute for sustainable development, 30/1/2018, available at: https://sdg.iisd.org/news/european-union-announces-collaborative-energy-projects/ (accessed 11 June 2019).

Helen, H. (2010), "The EU's energy security dilemma with Russia", *Polis Journal*, Vol. 4.

Hughes, L. (2006), "Preparing for the peak: energy security and Atlantic Canada", Ontario, available at: http://lh.ece.dal.ca/enen/2006/ERG200606.pdf (accessed November 2018).

Hughes, L. (2011), "A generic framework for the description and analysis of energy security in an energy system", Energy Research group, available at: http://lh.ece.dal.ca/enen/2011/ERG201104.pdf (accessed on 17 November 2018).

IGI Poseidon (2018), "Eastmed: a direct link to new sources for Europe", available at: www.igi-poseidon.com/en/eastmed (accessed 20 August 2017).

International Energy Agency (2011), "Measuring short-term energy security", Paris, pp. 2-3, available at: www.iea.org/publications/freepublications/publication/Moses.pdf (accessed 1 November 2018).

Jewell, J. and Cherp, A. (2011), "The three perspectives on energy security: intellectual history, disciplinary roots and the potential for integration", *Current Opinion in Environmental Sustainability*, Vol. 3.

Jewell, J., Cherp, A., Vinichenko, V., Bauer, N., Kober, T., McCollum, D., Van Vuuren, D. and Van Der Zwaan, B. (2014), "Energy security of China, India, the EU and the US under long-term scenarios: results from six IAMs", *Climate Change Economics*, Vol. 4 No. 4.

Kabouche, L. (2018), "The energy briefing: will US gas exports to Europe surge?", Global Risk Insights.31/8/2018, available at: https://globalriskinsights.com/2018/08/surge-us-lng-europe-natural-gas-gazprom/ (accessed on 10 June 2019).

Kocaslan, G. (2014), "International energy security indicators and turkey's energy security risk score", *International Journal of Energy Economics and Policy*, Vol. 4 No. 4.

Kravtsova, E. and Zawadzki, S. (2019), "Europe tops buyers for US LNG with winter cargo influx", Reuters. 25/1/2019, available at: www.reuters.com/article/us-lng-usa-europe-exclusive/exclusive-europe-tops-buyers-for-u-s-lng-with-winter-cargo-influx-idUSKCN1PJ0YH (accessed 11 June 2019)

Kuik, O. (2003), "Climate change policies, energy security and carbon dependency trade-offs for the European union in the longer term", *International Environmental Agreements: Politics, Law and Economics*, Vol. 3 No. 3.

Leal-Arcas, R., Rios, A. and Grasso, C. (2015), "The European union and its energy security challenges: engagement through and with networks", *Contemporary Politics*, Vol. 21 No. 3.

Lewis, B. and Emmott, R. (2014), "EU leader accelerate quest to reduce energy reliance on Russia", Reuters, available at: www.reuters.com/article/us-ukraine-crisis-energy/eu-leaders-accelerate-quest-to-reduce-energy-reliance-on-russia-idUSBREA2K0SV20140321 (accessed 1 December 2018)

Lovins, A. and Lovins, H. (1981), *Energy Policies for Resilience and National Security*, Friends of Earth, San Francisco, available at: https://apps.dtic.mil/dtic/tr/fulltext/u2/a108263.pdf (accessed 10 October 2018).

Luft, G. and Korin, A. (2009), *Energy Security Challenges for the 21st Century: A Reference Handbook (Contemporary Military, Strategic, and Security Issues)*, Praeger Security International.

Margheri, M. (2017), "The East med pipeline project: a project of common interest for the diversification of gas supplies to Europe".

Markandya, A. Costantini, V. Gracceva, F. and Vicini, G. (2005), "Security of energy supply: comparing scenarios from a European perspective", NOTA DI LAVORO, Fondazione Eni Enrico Mattio, Milano, available at: www.feem.it/m/publications_pages/NDL2005-089.pdf (accessed 30 October 2018).

Miller, L. (1977), "Energy, security, and foreign policy, a review essay", *International Security*, Vol. 1 No. 4.

Neff, T. (1997), "Improving energy security in Pacific Asia: diversification and risk reduction for fossil and nuclear fuels", MA, available at: http://oldsite.nautilus.org/archives/papers/energy/NeffPARES.pdf (accessed 17 November 2018).

Nurdianto, D. and Rosousdarmo, B. (2011), "Prospects and challenges for an ASEAN energy integration", *Environmental Economics and Policy Studies*, Vol. 13 No. 2.

Palonkorpi, M. (2018), "Energy security and the regional security complex", Aleksanteri Institute, Helsinki, available at: https://docplayer.net/42139190-Energy-security-and-the-regional-security-complex-theory.html (accessed 19 December 2018).

Politi, J. and Farchy, J. (2016), "Eni sells 30% stake in Egyptian gas field to Rosneft", The Financial Times, available at: www.ft.com/content/257abfdc-c070-11e6-9bca-2b93a6856354 (accessed 8 July 2017).

Raines, T. and Tomlinson, S. (2016), "Europe's energy union: foreign policy implications for energy security, climate and competitiveness", *Europe Programme Energy, Environment and Resources*, Chatham House, The Royal Institute of international Affairs, available at: www.chathamhouse.org/sites/files/chathamhouse/publications/research/2016-03-31-europe-energy-union-rainestomlinson.pdf (accessed 18 November 2017).

Sovacool, B., Sidortsov, R. and Jones, B. (2014), *Energy Security, Equality and Justice*, 1st ed., Routledge, London.

The Guardian (2015), "Eni discovers largest known gas field in Mediterranean", available at: www.theguardian.com/business/2015/aug/30/eni-discovers-largest-known-mediterranean-gas-field (accessed 18 July 2017).

The Times of Israel (2018), "Israel, Cyprus, Greece and Italy agree on $7b East Med gas pipeline to Europe", available at: www.timesofisrael.com/israel-cyprus-greece-italy-said-to-agree-on-east-med-gas-pipeline-to-europe/ (accessed 9 June 2019).

Tufail, M., Ibrahim, J. and Melan, M. (2018), "Conceptualizing energy security and the role of diversification as the key indicator against energy supply disruption", *Journal of Advanced Research in Business and Management Studies*, Vol. 11 No. 1.

Umbach, F. (2014), "Russian-Ukrainian-EU gas conflict: who stands to lose most?", NATO Review Magazine, available at: www.nato.int/docu/review/2014/NATO-Energy-security-running-on-empty/Ukrainian-conflict-Russia-annexation-of-Crimea/EN/index.htm (accessed on 11 June 2019).

UNDP (2000), *Energy and Challenges of Sustainability*, World Energy Assessment, New York, NY, available at: https://bit.ly/2SioO6r (accessed 1 October 2018).

UNDP (2004), *World Energy Demand: overview 2004 Update*, World Energy Assessment, New York, NY, available at: www.undp.org/content/undp/en/home/librarypage/environment-energy/sustainable_energy/world_energy_assessmentoverview2004update.html (accessed 10 October 2018).

UNDP (2012), "Energy and poverty in the context of climate change", Background papers Series, available at: www.uncclearn.org/sites/default/files/inventory/undp305.pdf (accessed 25 November 2018).

World Bank (2005), "Energy security issues", Washington, DC, available at: http://siteresources.worldbank.org/INTRUSSIANFEDERATION/Resources/Energy_Security_eng.pdf (accessed 15 October 2018).

Yergin, D. (1988), "Energy security in the 1990s", *Foreign Affairs*, Vol. 67 No. 1.

Yergin, D. (2006), "Ensuring energy security", *Foreign Affairs*, Vol. 85 No. 2.

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