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Energy Relations between the European Union and North Africa under the Prism of the Theory of Interdependence

Bachelor thesis

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Zadání bakalářské práce

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Cíl, metody, literatura, předpoklady:

The assignment work deals with the relationship between the European Union and North Africa in the sector of energy under the prism of interdependence theory. The main objective of the thesis will be to determine whether the relation between the European Union member states and three North African states, namely, Algeria, Egypt, and Libya can be characterized as interdependent. In such state of affairs, the secondary objective will then be to identify whether there is a symmetrical or asymmetrical type of relation between the European Union and North Africa. Due to the lack of academic research & associated literature within the chosen field it is essential to define the nature of the European Union and North Africa relation. The conceptual framework of the thesis will be based on the neoliberal theory of interdependence. Two methodological discourses chosen for this bachelor thesis are case study research and comparative analysis.

Alami, Randa. 2005. Changing Financial Structures in the Arab World: Some Implications for Oil and Gas. FIO, Oxford: Oxford Institute for Energy Studies. Chivvis, Christopher S., and Jeffrey Martini. 2014. Libya After Qaddafi: Lessons and Implications for the Future. Rand Corporation. Dreyer, Iana, and Gerald Stang. 2014. Energy moves and power shifts: EU foreign policy and global energy security. Paris: EU Institute for Security Studies. Emerson, Michael, Gergana Noutcheva, and Nicu Popescu. 2007. European Neighbourhood Policy Two years on: Time indeed for an'ENP plus'. CEPS Policy Briefs 126. Keohane, Robert Owen, and Joseph Samuel Nye. 1977. Power and interdependence: World politics in transition. 2nd ed. Boston: Little-Brown. Keukeleire, Stephan, and Tom Delreux. 2014. The foreign policy of the European Union. 2nd ed. Houndmills, Basingstoke, Hampshire: Palgrave Macmillan.

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Declaration of Authorship

I hereby attest that this thesis and its content is based on my own work, unless stated otherwise. All the references and sources of information used to compose this thesis have been quoted and acknowledged, under the supervision of my supervisor.

In Hradec Králové 13.7.2017

Signature

Abstract

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Key words: European Union, North Africa, energy security, energy trade, theory of interdependence

Anotace

POLOSINA, MARGARITA. Energetické Vztahy mezi Evropskou Unií a Severní Afrikou pod Prizmatem Teorie Vzájemné Závislostí. Hradec Králové, Filozofická fakulta, Univerzita Hradec Králové 2017, 69 s. Bakalářská práce.

Práce se zabývá vztahy mezi Evropskou unií a severní Afrikou v oblasti energetiky pod prizmatem teorie vzájemné závislosti. Hlavním cílem bakalářské práce bude zjistit, zda vztah mezi členskými státy Evropské unie a třemi severoafrickými státy, jmenovitě Alžírskem, Egyptem a Libyí, lze charakterizovat jako vzájemně závislý. V takovém případě bude druhým cílem zjistit, zda existuje symetrický nebo asymetrický typ vztahu mezi Evropskou unií a severní Afrikou.

Vzhledem k nedostatku akademického výzkumu a související literatury ve zvolené oblasti je nezbytné definovat povahu vztahů mezi Evropskou unií a severní Afrikou.

V teoretické rovině práce bude založena na neoliberální teorii vzájemné závislosti. Hlavními metodami použitými v této bakalářské práci jsou případová studie a komparativní analýza.

Klíčová slova: Evropská unie, severní Afrika, energetická bezpečnost, obchodování s energii, teorie vzájemné závislosti

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LIST OF ABBREVIATIONS

ACER	Agency for the Cooperation of Energy Regulators
ENTSO-E Electricity	European Network for Transmission System Operators for
ENTSOG Gas	European Network for Transmission System Operators for
ENI	European Neighbourhood Instrument
ENP	European Neighbourhood Policy
EU	European Union
IEA	International Energy Agency
LNG	Liquefied natural gas
NA	North Africa (Algeria, Egypt, Libya)
OPEC	Organization of the Petroleum Exporting Countries
TFEU	Treaty of functioning of the European Union
UfM	Union for Mediterranean

Introduction

From the beginning of civilization, energy either in form of human being or animal muscle power has played a colossal role in people's lives. Humans have developed energy system with pattern that is valid until even today's modern age: generating as much energy as possible with the minimal human effort (or cost). Gradually, with the development of world order as well as scientific advancement, energy sources have become not only a vital necessity of the states but more importantly the source of their power. Nevertheless, western states have not realized the role of energy politics and importance of ensuring energy security until 1973 when Organization of the Petroleum Exporting Countries proclaimed oil embargo (Yergin 2006: 75).

Although both the consumers and producers of energy sources tend to be concerned with the state of their energy security, the meaning of the term and ways of ensuring the security are different for them. While consumers are trying to ensure the availability of natural recourses for energy consumption (at a given time for a reasonable price), the producers, contrariwise are aiming to secure steady demand for their energy commodities export at a stable price. Henceforward, taking into consideration such a disparity within the aims of two types of energy trade partners, there occurs more or less imbalanced, (inter)dependent form of trade relation between the consumers and producers.

Considering the geographical position of the Europe and North Africa and more importantly the existence of the continuous requirement of energy-sources-import on the European side and the level of interest in exports on the North African side, it is not surprising that the two regions have become a long-term trade partners. At this juncture of the work and its scope it is important to specify that for the purpose of this work EU is considered to be a single political unit which consists of 28 member states, while North Africa refers to three states, which can be characterised as energy commodities exporting countries, namely: Algeria, Egypt, and Libya. Although the geographical region of North Africa also includes Morocco and Tunisia, these countries are excluded from this research

due to their essence mainly recognized as transit countries (Darbouche 2010: 13). Considering the importance of the EU's energy import, which constituted 53.5% of gross energy consumption of the 28 member states in 2014 (Eurostat: 2016a) and its reliance on Russian energy commodities imports, it is compelling to evaluate the state of energy trade between the EU and North Africa witnessing the European Union attempts to diversify the energy supply.

The topic of balance/imbalance or symmetry/asymmetry of a trade relation and subsequently the (inter)dependence of the states on one another has been widely discussed in academic literature. Although, scholars do not agree on the terms and definitions (Baldwin 1980, Caporaso 1978, Cooper 1985, Keohane, Nye 2001, Rosecrance, Stein 1973), it is clear that the nature of the relationship between the trade partners plays a significant role in the formation of their policies.

The thesis will aim to analyse the relation between the European Union and North African states in energy sector under the prism of the theory of interdependence. The focal objective (1) of the work is therefore as follows: can the relation between the European Union and three North African states be characterised as interdependent? In such case, the second objective (2) is to determine whether the type of interdependent relationship is of a symmetrical or asymmetrical nature. The primary hypothesis of the work (1) assumes that the interdependence is present in the energy relation between the EU and North Africa. The second hypothesis (2) assumes that the existing interdependence can be characterised as asymmetrical and EU is in a more advantageous position. Since the second hypothesis is dependent on hypothesis one, it is vital that it is confirmed first so that the second hypothesis could be verified effectively.

The main theoretical foundation of the thesis is the neoliberal theory of interdependence, as described in the work of Robert Keohane and Joseph Nye in "Power and interdependence" (2001). The authors tend to discuss the forms of interdependent relationship and its implications on the policy-making process of the states (Keohane, Nye 2001). Another theoretical foundation vital for this work is the concept of energy security. The concept is used for determination of the key

aspects of the analysis of the relations between the EU and North Africa in the energy sector.

Reflecting on the peculiarity of the topic of this thesis and the needs of the research objectives, the two research methods have been adopted, as follows: (1) case study research and (2) comparative analysis. The proposed research methods will allow the conduction of a detailed analysis of the European Union and North African energy security and policy, providing a profound understanding of their energy relations (Drulák et al. 2008: 33).

In order to answer the research questions above, the work in this thesis has been divided into four parts (chapters). The first chapter will discuss the theoretical concepts relating the thesis aim, which will be used throughout the thesis, mainly focusing on energy security and interdependence theory. This chapter will also provide with the deeper explanation of the types of interdependence as defined by Robert Keohane and Joseph Nye, as well as its measurement, developed by Richard Emerson and Katherine Barbieri. The second chapter will discuss the energy security and policy of the European Union and three North African states, with regard to the aspects relevant for both consumers and producers of energy sources. The third chapter will evaluate the existence of interdependence between the EU and North Africa using criteria developed by Mikko Palonkorpi. Subsequently, the forth chapter will measure the type of interdependence between each of the three North African states separately in relation to the European Union as a whole. Finally the last part of work will be devoted to the evaluation of the results, answering the research questions, and verifying the hypotheses.

1. Theoretical framework

To determine whether the relations between the European Union and three North African states in energy sector can be characterised as interdependent and evaluate the type of the interdependence the theory of interdependence as described in works of Robert O. Keohane and Joseph S. Nye has been chosen.

The section 1.1 of this chapter will be devoted to the concept of energy security. Next sections (1.2 & 1.3) will discuss theory of interdependence in depth. The section 1.2 will focus on the definition of the terms "dependence", "dependency", and "interdependence" from different perspectives. Subsequent two subsections (1.2.1 & 1.2.2) will be devoted to the explanation of the symmetrical and asymmetrical interdependence as well as differentiations between sensitivity and vulnerability interdependence. The section 1.3 will describe the methods used to determine the existence of interdependence between the actors as well as measurement of interdependence, which will then be used in the analytical part of this thesis.

1.1 Energy security

Considering the fact that the relations between the EU and North Africa in energy sector are the main focus of this work, it is important to discuss the energy security of the researched regions.

The term "energy security" has been introduced to the scholarly discourse by Barry Buzan relatively short time ago. Since 1990's when the term has just appeared the scholars, mainly the international relations and security studies theorists have been trying to develop a complete definition of the term (Tichý 2012). International Energy Agency (IEA) defines energy security as "the uninterrupted availability of energy sources at an affordable price" (International Energy Agency 2017a). However the analysis of the term should be able to depict both of the energy relation partners' points of view: consumers and producers, as

well as it should provide the consolidated definition encompassing economic and political aspects of energy security (Palonkorpi 2006: 2). For example, energy producing states are focused on securing the reliable demand of their export, since its decline could bring dreadful losses for the exporter's economy. On the contrary energy importing countries are more concerned about the reliability of unceasing supply at affordable prices as all of the aspects of economy and even existence of the state is dependent on continuous supply of energy (Yergin 2006: 70–71). As regards the economic aspect of energy security, it refers to energy supply price and its economic dimensions. From this perspective, "energy insecurity" is defined as "the loss of welfare resulting from a change in the price or physical availability of energy" (Labandeira, Manzano: 9). Yet, energy relations can induce the occurrence of dependence (or interdependence) within the relationship, and therefore create a possibility of usage of energy as a political weapon i.e. the room for existence of a political aspect of energy security (Palonkorpi 2006: 2).

Furthermore IEA distinguishes between the short-term and long-term energy security. The short-term energy security focuses primarily on the ability of the energy system to respond to the rapid changes within the balance of supply and demand of energy in the market to prevent the critical situations. The long-term energy security, as is evident from the name, deals with timely investments to energy supply together with the economic development of the domain as well as environmental issues (International Energy Agency 2017a).

Hence traditionally countries have recognized and been following certain principles in order to ensure energy security. The diversification of energy supply sources became a pioneer of energy security strategies, and it remains effective up to now. Ever since Churchill made a decision to fuel the British navy with the oil instead of home-produced coal, the energy security relocated to the foreign policy domain and, at the same time, shifted its key instrument to the "variety and variety alone." However, one must take into account that the evolution of the energy trade since that time has brought new approaches to ensuring energy security. Globalization and interconnectedness of nowadays world push states to take into account the supply-chain vulnerability, terrorist threat, and integration of new economies into the global market. The new threats induce the new ways of ensuring energy security such as: ensuring the access to high-quality information,

recognizing the reality of integration by admitting the impossibility of separation from the global market, or acknowledging the need of protection of the entire energy supply-chain and infrastructure (Yergin 2006: 76 –77).

The growing scope of the energy trade and deepening energy relations within the states require permanent cooperation of the actors participating in the trade. It must be acknowledged, that energy security is not located independently, but it exists within the greater context and depends much on the bilateral and multilateral interactions between the states (Yergin 2006: 69–82).

1.2 Interdependence theory

Scholars do not agree on a clear definition of interdependence even in spite of the large debate over the term. Depending on what aspect of interdependence the particular author considers as the key one, the definitions vary.

However, one cannot define interdependence without defining the term "dependence" first. Since interdependence is seen as a condition of mutual dependence between two or more actors, the definition of the term turns out to be two-stage: at first it is necessary to determine what dependence is, the second stage therefore is to define the interdependence as a condition of mutual dependence (Jones 2001: 788).

James A. Caporaso (1978) distinguishes two different concepts: "dependence" and "dependency", and outlines their key differences. According to him, terms "dependence" and "dependency" are two divergent groups of phenomena – though both comprising the element of reliance on external factor, they cannot be unified under one theoretical approach. Caporaso demonstrates the distinction of the concepts by pointing out the differentiation of assumptions, traditions, and measurement models dependence and dependency rely on (Caporaso 1978: 43).

David A. Baldwin (1980) in his turn provides a comprehensive analysis of the term(s). He differentiates between the understanding of "dependence" and

"dependency" by comparing the approaches of different groups of scholars (i.e. economists, international relations theorists, or general scholarly approach) as well as common usage of the term(s). He comes to the conclusion that "dependence" is meant to be a condition when one actor externally rely on the other actors, while " dependency" refers to "the process of incorporation of less developed countries into the global capitalist system and the 'structural distortions' resulting therefrom" (Baldwin 1980: 492).

In the matter of interdependence, the most conventional meaning of the term is defined as a relation between two or more actors, which presupposes one actor's position change would influence the change of the position of the other actor(s) afterward (Rosecrance, Stein 1973: 2).

In world politics interdependence relates to the situations of actors' influence on each other. These actors could not necessarily be countries, but they could as well be various actors within the states. The influence created in such type of relationship is often an outcome of the "international transaction flows" – i.e. "flows of money, goods, people, and messages" (Keohane, Nye, 2010, p. 7) across the borders of nation states. However, one should distinguish between "interconnectedness" and interdependence. Interconnectedness as an effect of the transaction flows will rely on the costs related to those transactions.

Mutual influence of the actors on one another will necessarily limit the autonomy of the countries, and hence interdependence will at all times encompass certain costs. The situations of mutual influence hereof do not automatically mean that these relations will bring mutual benefit since the costs may as well exceed the profit. The evaluation whether the relationship brings more benefits or losses will depend on the "values" of each actor and "nature" of their relationship (Keohane, Nye 2001: 7–8).

According to another definition derived from economics, interdependence is determined by measurement of the economic transactions' cost between two states, or between the state and every other actor in the global economy scaled to either total yield of the state or its total assets (Cooper 1985: 1197).

Rosecrance and Stein (1973) develop their definition of interdependence in contrast to Kenneth Waltz's definition of interdependence as a "relationship that would be costly to break". They argue that interdependence is not as much defined by the cost of the breaking of interdependent relationship, rather than by "the degree to which economic interests are direct functions of one another" (Rosecrance, Stein 1973: 2–12).

1.2.1 Symmetrical and asymmetrical

Interdependence should not be necessarily characterised as a situation of equal reciprocal dependence of one unit on another. Such state of affairs is named "symmetrical interdependence" and is believed to be one of the extremes of interdependent relationship (Keohane, Nye 2001: 9). Literature suggests that analogous degree of mutual dependence between states reduces the risk of engaging in militarized conflicts. Symmetry in trade relations is believed to reduce the possibility of disputes between the actors; however symmetry in other forms of relationship increases the probability of militarized disputes (Barbieri 1996: 40).

Asymmetrical interdependence, on the other hand, creates sources of power for the actors engaged in the relations. More dependent states can occur in less advantageous bargaining position against the less dependent partner (Keohane, Nye 2001: 9). Being less able to alter their trade partners, less powerful states may become a subject of manipulation or compulsion either in economic or political realm. The power over the more dependent unit may be exercised in order to gain sufferance or concessions, and therefore it is possible that dependent state ought to confront "negative political consequences" (Barbieri, 1996, p. 32). The power gained from the asymmetrical relation by less dependent state in the trading relation may limit the more dependent partner in trade, economic, and political opportunities and therefore make it vulnerable to different forms of manipulations and coercion (Barbieri 1996: 32).

Asymmetrically interdependent relationship is often believed to be likely to cause interstate conflicts (Gartzke, Li, Boehmer 2001: 416). As Barbieri (1996) concludes, existence and misuse of influence provided by asymmetrical relations generate tendency of the actors to engage in military interstate disputes, which is

stronger that the symmetrical relations created probability of the eruption of the conflict. Liberal presumption that trade defuses the tensions in not applicable in the situation of absence of disposable benefits of the trade between asymmetrically interdependent states. Moreover, tensions could appear even if the trade provides absolute gains for the states taking part in trading relations – in this case the disputes may arise over the even distribution of the trade benefits, i.e. states in this case would be engrossed in relative benefits of the trade (Barbieri 1996: 32).

Somewhat uncommon judgment on symmetrical and asymmetrical interdependence can be found in Baldwin's (1980) work. He discusses *reciprocity*, rather than interdependence and claims that dependency, as well as power, cannot be at their core symmetrical. States may be concurrently dependent on each other in similar areas, such as military security or standard of living, but they may also be dependent on each other in different areas simultaneously. For instance, in dyadic trade relationship one state may be dependent on the other in regard to natural gas, while the other one may be dependent in regard to technology. Such relations are characterised with the term "intercursive power" – i.e. the condition under which the control of one unit over another is "balanced" with the control of the other unit in different sphere (Baldwin, 1980: 503–504). Thus, while one unit enjoys the dominant position in one scope, the situation changes with regard to different sphere of conduct, when the other unit take over the power.

It is also necessary to notice, that "intercursive dependency" may or may not be balanced. Although states may both depend on each other in different scopes, yet the value of the import/export goods varies. For example, in trading relationship dyad, one unit which imports oil and natural gas, but exports manufactured goods to the other state in dyad may view the relationship as imbalanced and consider itself in a less beneficial position. Thus, the relation may be labeled as "intercursive dependency", but is does not necessarily mean that both of the units in the dyadic relationship consider it to be "balanced" (Baldwin, 1980: 132–133).

To sum up, both extremes of the interdependence i.e. mentioned above "pure symmetry" of the trade relationship, whether it exists or not, and "pure dependence" which is at times labeled as interdependence are very exceptional. Most of the times the relationship between actors is placed between these two extremes and that is where one can find "the heart of the political bargaining process of interdependence" (Keohane, Nye, 2001, p. 9).

1.2.2 Sensitivity and vulnerability

The definition of interdependence has provoked disputes between scholars over the term, especially for the reason of multi-dimensional nature of interdependence. In order to understand the role of actors in interdependent relation better, one must clearly distinguish between two dimensions of interdependence, sensitivity and vulnerability.

Sensitivity interdependence is characterised by the degree of openness to changes between two economies i.e. how rapidly the policy changes implemented by one state bring costly changes to the other state in the trade dyad and what is the extent of these effects (Keohane, Nye 2001: 10). Two units in a dyadic trade relationship are considered as sensitivity interdependent if economic situation in one state is reliant on the economic condition of the other state (Mansfield, Pollins 2001: 847). In other words, sensitivity interdependence may be defined as "mutual sensitivity" of the trade units to policy changes (Baldwin 1980: 492).

Sensitivity is created by relations within the frame of particular policies and assumes that the framework of these policies remains the same. It is defined by (1) the volume of flows of goods between the units and (2) by the costly effects caused by policy changes on the societies and governments (Keohane, Nye 2001: 10).

Sensitivity interdependence itself measures the extent to which trade units must coordinate changes in their policies, so as to the new policies do not deviate from each other in order to attain discernible result of these policies (Kroll 1993: 330).

As for the vulnerability interdependence, it relies on the relative accessibility of the implementation of substitutive policies by actors in trade

relationships. One must refer to the vulnerability interdependence in the situations, when the framework of policies could be changed i.e. the price of modifying the policy with the available alternatives in accord with the other actor's policy change (Keohane, Nye 2001: 11). To put it differently, the states are considered vulnerability interdependent if it would be costly to break or forego this trade relationship (Mansfield, Pollins 2001: 847).

Vulnerability is measured by the assessment of costliness of the modification of the policies performed by the actors of the trade relation in order to adjust to a new situation over a period of time. Vulnerability interdependence is related to consequence of changes in either formal or informal regulations or norms of trade or sets of policies. Such situations may comprise strikes, embargoes, or other trade disruptions, which change the previous regulations and cause considerable additional costs for the trade partners (Keohane, Nye 2001: 11).

Ultimately the main difference between sensitivity and vulnerability interdependence centers in the costs the states would bear in a situation when the trade relations between them are disrupted (Mansfield, Pollins 2001: 847). Sensitivity interdependence refers to reciprocal effects of change of policies, while vulnerability interdependence is defined in terms of the opportunity costs of disrupted relationship (Baldwin 1980: 492). To put it other way, sensitivity can be defined as state's liabilities to the effects of change imposed by external forces before the state's modification of the policies in order to minimize the aftermath. On the other hand, vulnerability means an actor's liability to bear the costs following the implementation of new policies even afterwards their appliance (Keohane, Nye 2001: 11).

Both sensitivity and vulnerability interdependence lead to forthcoming potential political power of a less interdependent unit of a relationship (i.e. more independent), however there are particular limitations. Sensitivity interdependence is able to deliver more or less substantial political influence only while the regulations and norms of the trade relation are foreordained, or while the cost of an attempt to change the policies quickly by less satisfied state would be excessively high. Additionally if the cost of changing the disadvantageous rules is

somewhat reasonable, the actor which gets relatively less benefits from the trade would perhaps try to change them. Consequently, the sensitivity interdependence provided power originating in advantageous (for the less dependent state) asymmetries is limited in a situation when the basal asymmetries in vulnerability interdependence are hostile (Keohane, Nye 2001: 15).

1.3 Measurement of interdependence

Interdependent relationships characterise with the (a)symmetrical power of one (less dependent) actor over the other (more dependent); therefrom influence of one of the actors is in the other actor's dependency (Emerson 1962: 32). In order to fully understand the nature of interdependent relationship it is necessary to specify the method of proving the existence of the interdependence as well as its subsequent measurement.

The research method chosen for identifying the existence of interdependence and its measurement is as follows: first and foremost it is necessary to prove the existence of the two-way dependent relationship between the EU and North Africa. The evaluation of the strength of energy dependency of the importer (European Union) will be done by measuring the (1) energy trade balance, (2) level of (domestic) energy resources and (3) possibilities for diversification of energy supplies. However, it is important to balance these figures against total energy mix of the single states, i.e. the scale to which the importer states are dependent on the certain energy resource imported (Palonkorpi 2006: 3). As regards the exporter of energy commodities (Algeria, Egypt, and Libya) the strength of the dependency will be measured by the scale of the dependence of the supplier on the energy exports. The indicators are as follows: (1) the ratio of income of the oil and gas exports to GDP formation, (2) the ratio of income of energy raw materials export to government budget, and (3) the ratio of the energy export revenues to the total export (Palonkorpi 2006: 3; Tichý 2011).

Afterwards in the event of discovering the reciprocal dependency relationship between the European Union and North Africa, the discovered notion of interdependence will induce the further research on the nature of the interdependent relationship between the actors. The so called symmetry or asymmetry in the interdependent relationship will be determined using the method introduced by Richard Emerson (1962).

In order to determine whether the relation is balanced or imbalanced it is necessary to comprehend the original formula describing the interdependent relationship. As previously mentioned, the power of the actor A resides in the dependence of the actor B. Therefrom, the dependence of actor A upon actor B is equal to the power of the actor B over the actor A:

$$Dab=Pba,$$

where Dab indicates the dependence of actor A upon actor B and Pba designates power of the actor B over the actor A.

Taking into account the mutual nature of the relationship, the formula can be understood conversely:

$$Dba=Pab,$$

i.e. the dependence of the actor B upon actor A is equal to the power of actor A over the actor B (Emerson 1962: 32–33).

Hence it is now possible to determine whether the relationship between actors A and B can be characterised and symmetrical (balanced) or asymmetrical (imbalanced). As mentioned above, the interdependent relationship does not necessarily mean that both parties of the relation benefit equally. In case of a symmetrical relationship expressed as:

$$Pab=Dba$$

$$\text{II} \quad \text{II}$$

$$Pba=Dab$$

power A over B in one case is indeed counterweighted by the power B over A in the other case, so that the relationship is balanced. However, this situation does

not characterise all of the interdependent relations. The asymmetrical interdependent relation expressed as:

$$Pab=Dba$$

$$\vee \quad \vee$$

$$Pba=Dab$$

describes the situation when the dependence of actor A on actor B is less than the dependence B upon A, and hence A happens to be more powerful and has an ability to exercise pressure on the actor B (Emerson 1962: 34).

Subsequently, the final phase of identifying the kind of the interdependent relationship will be completed using a method of measurement of interdependence which is constructed on the basis of salience of trade developed by Katherine Barbieri (1996). The method comprises two phases of measuring the (a)symmetry of the dyadic trade relationship. First, it is necessary to evaluate the relative importance of the particular trade relation for the actor compared to the other actors by calculating the trade share sustained by the state within the interdependent trade relation. The calculation is as follows:

$$Trade\ Share_{A} = \frac{Dyadic\ trade\ AB}{Total\ trade\ A}$$

Finally, the trade shares of the states A and B will be used to calculate the (a)symmetry of the interdependent relationship:

$$Symmetry_{AB} = 1 - \left| Trade\ Share_{A} - Trade\ Share_{B} \right|$$

Symmetry of the interdependent relationship is calculated by 1 minus the absolute value of the difference in the shares of trade of both partners of the trade relationship. The result will conform on the scale from 0 to 1, with higher score signifying the greater equality within the interdependent relationship (i.e. greater symmetry), and smaller score indicating the more asymmetrical nature of the relationship respectively (Barbieri 1996: 36).

2. Energy security and policy

Evaluation of the type of interdependence between the European Union and three North African states would be impossible without general review of the state of their energy security and implementation of energy policies. Thus, the second section of this work will be devoted to the specification of the state of energy security and policy of EU and NA with regard to the aspects most relevant for the research.

First section (2.1) will discuss the European Union energy security as an importer of energy resources focusing on its consumption (subsection 2.1.1), import (subsection 2.1.2), production (subsection 2.1.3), and legal framework (subsection 2.1.4). The section 2.2 will focus on North African energy security with regard to aspects of exporter countries. Subsections 2.2.1, 2.2.2, and 2.2.3 will provide a discourse into Algerian production, consumption, and export. Next three subsections (2.2.4, 2.2.5, and 2.2.6) will focus on Egypt, and final three subsections (2.2.7, 2.2.8, and 2.2.9) will discuss Libyan aspects of energy security. The third and final subsection (2.3) will focus on the energy partnership between the European Union and North Africa.

2.1 European Union

2.1.1 Consumption

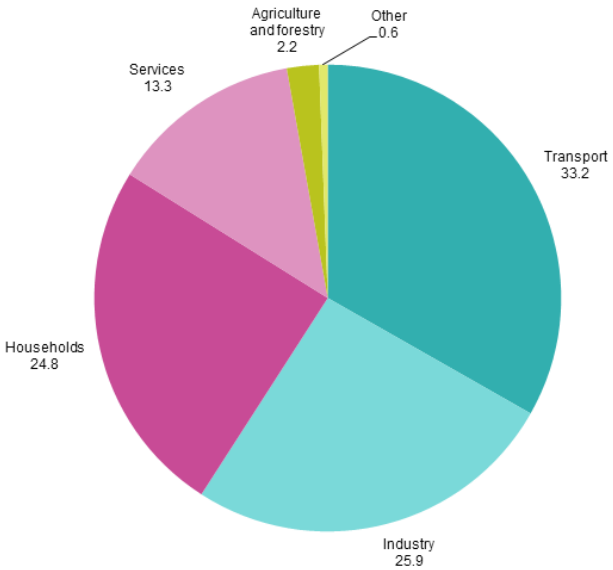
European Union is one of the biggest energy consumers in the world. Total world energy consumption in 2016 constituted 13276.3 million tons of oil equivalent (Mtoe), EU-28 energy consumption was 1642.0 Mtoe. With 12.3 per cent share of the total world's consumption, EU only followed China with 22.9 per cent and the US with 17.1 per cent of total primary world consumption (British Petroleum 2017a).

In 2014 the gross inland energy consumption which represents the total amount of energy consumption of a region and includes final energy consumption of the users, consumption of the energy sector, distribution and transformation losses, as well as statistical differences (Eurostat 2013) of the EU-28 was 1605.9

Mtoe. Together with Iceland and Norway the number goes up to 1641.2 Mtoe that is 4.49 million tons of oil equivalent per day. Germany consumed the highest amount of energy – 313 Mtoe, followed by France and the United Kingdom – 248.5 and 189.3 Mtoe respectively. These three countries together consumed 46.8 per cent of total gross inland energy consumption of the EU in 2014. The lowest primary energy supply was found in Cyprus with consumption only 2.2 Mtoe a year (which is twice lower than daily consumption of the EU) (Eurostat 2016).

As regards the structure of final end use of energy in the European Union in 2014, the largest energy-consuming sector was transportation with 353 Mtoe and 33.2 per cent share in total final end-use energy consumption. Industry is the second largest consumer and amounts 25.9 per cent, the third is households sector with 24.8 per cent, followed by services with 13.3 per cent, agriculture and forestry with 2.2 per cent, and other constituting of just 0.6 per cent of total end-use energy consumption in the European Union (Figure No. 1).

Figure No. 1. Energy consumption by end-use sector (%)



Source: Eurostat 2016.

2.1.2 Import

The European Union is dependent on primary energy imports. Sustaining the modern economies with high level of energy consumption leads to the necessity to import 53 per cent of the all energy it consumes. Overall import of

energy materials counts 20 per cent of total EU imports, with the daily bill of over €1 billion (European Commission 2017a).

The level of imports of energy recourses varies in every country, as well as the amount of the total import of any given commodity, in respect of every particular country's amount of home resources, geological structure of the land, weather conditions, availability of the alternative sources of energy supply or energy policy. In total the EU member states import 90 per cent of its consumption of crude oil, 66 per cent of the consumption of natural gas, 42 per cent of coal and other solid fuels and 40 per cent of nuclear fuels including uranium (European Commission 2017a).

While European Union as a single political and economic unit is dependent on primary energy imports slightly more than a half, the situation in particular member states differentiates broadly. Numerous countries rely profoundly on a single supplier, and in some cases a state is dependent on a single supplier utterly (European Commission 2014a). Hungary and the Czech Republic in year 2007 served as good examples of the heavy dependence on Russian gas with 60 and 78 per cent respectively. However the Baltic States and Slovakia found themselves in a considerably more difficult situation: they relied on the natural gas supply from Russia by 100 per cent (in case of Slovakia the number is a little less significant – 98 per cent of all gas used in the country) (Krickovic 2015: 9).

Not surprisingly, Russia is the largest exporter of energy to the European countries, in 2014 it accounted for 29 per cent of all EU solid fuels imports, 30.4 per cent of the crude oil and 37.5 per cent of natural gas imports of the EU-28 (Eurostat 2016a).

In terms of the crude oil, Russia is followed by Norway as a second largest supplier with 13.1 per cent of total imports, Nigeria with 9.1 per cent and Saudi Arabia with 8.9 per cent of total crude oil imports. However, due to historic circumstances and geographic conditions Russia accounts for a slightly smaller amount of oil imported by EU (30.4 per cent) than next three biggest suppliers (31.1 per cent) (Eurostat 2016a).

In the same vein, as regards natural gas imports, the largest supplier due to historical development of the region is Russia with 37.5 per cent of entire gas imports of the EU. It is followed by Norway with 31.5 per cent, Algeria with 12.3 per cent and Qatar with 6.9 per cent share of the European imports. The situation in natural gas domain seems to be more balanced, although the Russian share in natural gas imports is greater (Eurostat 2016a).

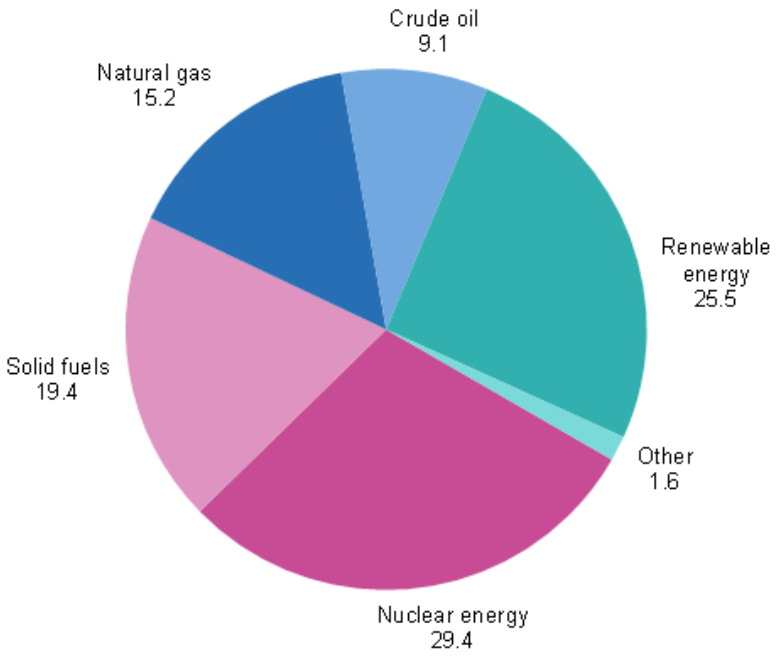
Speaking about solid fuels, once again Russia appears to be the biggest exporter and accounts for 29 per cent of total import, followed by Colombia with 21.2 percent, the United States which accounts for 20.5 per cent and South Africa with 9.9 per cent share on EU solid fuels imports (Eurostat 2016a).

2.1.3 Production

Although the European states are not self-sufficient in terms of energy supply, the 47 per cent of total energy supply is produced in the EU. In 2014 the European member states produced 771 million of tons of oil equivalent of primary energy production. The largest share (29.4 per cent) of the energy produced belongs to the nuclear energy (Figure No. 2) (Eurostat 2016a). Although there are nuclear power plants operational in 14 EU member states, more than 83 per cent of the total electricity produced in power plants is accounted for just 5 states, namely France with a 51 per cent share, Germany with the 10.7 per cent, United Kingdom with 8.2 percent, Spain with 6.7 percent, and Sweden with a 6.6 per share of the total nuclear energy production.

Nearly a quarter of the entire energy production of the EU in 2014 was accounted for renewable energy (Figure No. 2). Since 2004 renewable energy sources have been growing rapidly – the production has increased by 73.1 per cent over the period, while all the other primary energy sources have experienced production decrease (Eurostat 2017).

Figure No. 2: EU primary source production (%)



Source: Eurostat 2016b.

Solid fuels accounted for 19.4 per cent of EU energy production in 2014 (Figure No. 2). Poland accounted for a largest share of solid fuels (largely coal) produced – 80.2 per cent of a primary energy production, followed by Estonia with 78.5 per cent, and Greece with 72.5 percent of solid fuels produced domestically (Eurostat 2016b).

As regards natural gas which accounted for 15.2 per cent of the primary energy production (Figure No. 2), the largest share of produced energy by the member states in 2014 belonged to the Netherlands - 85.5 per cent of all the domestic energy (Eurostat 2016b). Natural gas is a vital part of the sustainable energy development, and therefore taking into account its flexibility and compatibility with renewables, its share in the EU production is expected to rise (The International Association of Oil & Gas Producers 2017).

The last major source of primary energy production among the 28 European Union member states is oil, with accounts for 9.1 per cent of total

production (Figure No. 2). The United Kingdom is the largest producer in the union with in 2015 was the only European country to be among the 15 largest oil exporters in the world (total value of oil exports accounted for $16 billion or 2 per cent of total world oil exports) (Workman 2017).

The general trend in primary energy production is negative – especially for nuclear and fossil fuels energy (oil production has fell by 52 per cent, while natural gas production declined by 42.9 per cent). However, renewables has experienced remarkable 73.1 per cent increase in production over the decade 2004–2014 (Eurostat 2016c), and as the following subchapter depicts, it is expected to rise more.

2.1.4 Legal framework

Although energy security has long been a part of the concern of the European policy-makers, the more or less unified approach in energy domain is a relatively new. Ever since the energy crisis of 1970s broke out, the general European trend moved towards nationalization of energy policy to in attempt to secure the national sovereignty (Keukeleire, Delreux 2014: 222).

The key to European integration since the Treaty of Rome in 1957 was economic cooperation in a wide range of issues; however the shared responsibility for energy policy has only came into sight in Lisbon treaty which came into force in 2009. Article 194 of the TFEU provides a legal basis for the energy domain constructed on shared competences between the EU and its member countries (EUR-Lex: n.d.) i.e. the national right to legislate in the energy area is removed from the member state when the EU decides to regulate the issue. The main objective of a newly shaped shared energy policy is "to ensure security of energy supply in the Union", however the policy guarantees no interference into member states home affairs and respect for sovereignty, and therefore highlights the greater role of the EU member states (Keukeleire, Delreux 2014: 222–223).

Notably, even before the Lisbon Treaty established shared responsibility between the EU and the member states in energy issues, the European energy and climate change policy was authorized by the Council while energy security and energy policy were still in the full competence of the states in 2008. The main

objective of this package is to reduce greenhouse gas emissions by 30 per cent or 20 per cent if no international agreement was reached (Carvalho 2012: 20).

One of the most important pieces of EU legislation in energy domain, specifically on European gas and electricity markets is referred to the Third package, which came into force in 2011. It involves 5 main strategies to improve the functioning of the EU energy market and resolve its structural problems:

1. unbundling energy suppliers from network operators.

"Unbundling is the separation of energy supply and generation from the operation of transmission networks" (European Commission n.d.-a) or to put it other way, companies that are involved in electricity and gas transmission may no longer generate or supply electricity/natural gas. Such situations lead to unfair competition on the market and potentially higher prices for consumers. The aim of this legislation is to eliminate any potential conflict of interests. The 3 basic models for unbundling are: Ownership Unbundling – where energy supply or production companies must sell their transportation networks, the Independent System Operator – where production company is allowed to keep its transmission networks, but it must leave the entire maintenance to an independent operator and the Independent Transmission Operator – in this case the supply company can still own the network, but the management must be done by a subsidiary of a parent company independently;

2. strengthening the independence of regulators.

Independent regulators ensure the right functioning of the market. In order to improve energy market, the independent regulators under the Third package legislation must be independent on both: suppliers and government, they must manage their own budget, but national governments are obliged to supply them with sufficient funds. Furthermore, regulators can issue binding decisions to companies, while the operators must provide accurate data;

3. establishment of the Agency for the Cooperation of Energy Regulators (ACER).

Although the European Regulator Group for Electricity and Gas had previously been working on the market regulatory issues, it proved to be insufficient to manage the regulation at EU level (European Commission 2011). Therefore, the Third package legislated an establishment of a new agency – ACER – to help national regulators from member states to cooperate independently from the governments, energy supply companies or Commission;

4. cross-border cooperation between transmission system operators and the creation of European Networks for Transmission System Operators.

Due to the cross-border energy market within the European Union, it is essential to harmonize the work of national transmission system operators in order to improve market functioning and stability. New organizations which are responsible for their cooperation and coordination are European Network for Transmission System Operators for Electricity (ENTSO-E) and the European Network for Transmission System Operators for Gas (ENTSOG);

5. increased transparency in retail markets to benefit consumers.

The Third energy package enables end-users to participate in the energy market effectively. It develops the right to choose or change suppliers without additional charges, get information on energy consumption, and resolve disputes more effectively (European Commission n.d.-a).

In February 2015 the European Union launched the Energy union project, which aims to provide "secure, sustainable, (and) affordable energy" (European Commission n.d.-b) and enable free cross-border energy flow. The project which is based on solidarity and cooperation between the EU member states involves 5 objectives: (1) to connect and unite the EU when negotiating with non EU energy suppliers, (2) to complete integration of the European energy market, (3) to moderate the EU energy demand by increasing energy efficiency, (4) to work on reducing the greenhouse gas emissions and decarbonizing the economy, and (5) to make the European Union the leader of global renewable energy (European Commission n.d.-b).

Following its desire of reaching a global climate deal the European Union has been at the forefront of the global climate action, which had only limited

reach within the framework of Kyoto Protocol or Copenhagen Accord. In March 2015 at the United Nations Climate Change Conference the EU has brought into life its long-term ambition of a collective climate action against global warming. Out of 195 countries signed the agreement the EU was one of the first to submit its intended contribution, subsequently ratifying the agreement in October 2016 and thus allowing it to come into force on November 4th, 2016 (European Commission 2017b).

2.2 North Africa

2.2.1 Algeria: production

Algeria is rich in natural resources – with 12.2 billion barrels of proven oil reserves and 4.51 trillion cubic meters of proven natural gas reserves (Stambouli 2012: 4447). The country is considered to be the third largest oil producer in Africa (following Nigeria and Angola) and the biggest producer of oil in North African region (African Vault n.d.). In 2015 Algeria was the 10th largest producer of natural gas in world – with 82 cubic meters (bcm) – and the first on African continent.

In 2008 it produced roughly 86.5 billion cubic meters of natural gas and 1.4 million barrels per day of crude oil (Stambouli 2012: 4447–4448). Oil production experienced a fast increase in the past due to the new fields' exploration: 43 per cent increase between 1996 and 2005; however after 2007 (when it peaked with 86 Megatonne TNT) it fell to 67.3 Mt in 2015, which is a 22 per cent decrease compared to 2007 level of production (Energy research Estore). In response to that Sonatrach – a government-owned energy company – is planning to invest 9 billion dollars this year to the new exploration projects, and subsequently spend 50 billion dollars more for the new fields' operation (Gulf News 2017).

Algerian overall energy production consists almost entirely of hydrocarbon resources. In 2014 oil accounted for 50.96 per cent and natural gas 49.01 per cent share of production. Hydropower generation of energy had a minor share, while none of the energy was produced using nuclear or renewable sources (Climate Policy Observer 2017).

However, Algeria, same as all North African countries are located in the zone which is highly suitable for concentrating solar thermal power plants. In Algeria there is a significant potential for geothermal as well as biomass energy. In February 2015 Algeria adopted a new Renewable Energy Program, which targets to install twice more renewable energy resources facilities by 2030 compared to the previous target and its share in a total electricity production is expected to go up to 27 per cent (Enerdata 2015).

2.2.2. Algeria: consumption

Algeria is facing a growing domestic energy demand. The total energy consumption multiplied by 2.5 in a decade – from 20.5 Mtoe to 50.9 Mtoe in 2012. The distribution of the final consumption in 2012 shows the big importance of two primary sources of energy: the petroleum products, which account for 38.5 per cent of total energy consumption, and natural gas with 26.7 per cent share, while fossil fuels or nuclear energy accounts for zero per cent (Hamiche, Stambouli, Flazi 2016: 270). However, Algeria in cooperation with Russian atomic energy corporation Rosatom is planning to put into operation its first nuclear plant in 2026 to satisfy the growing energy demand (World Nuclear News 2016).

The country's growing domestic energy consumption has become a great challenge for the Algerian government. While growth in demand of electricity is relatively easier to maintain under control, overall energy consumption is rising annually – in period from September 2014 to September 2015 it ascended by 7.5 per cent and constituted 43 Mtoe (African News 2016).

According to World Bank 100 per cent of the Algerian population had access to electricity in 2014 (The world Bank 2017). Greater living standard leads to the higher level of access to electricity and thus higher consumption. Total final energy consumption constituted 35019 ktoe (kilotonne of oil equivalent) in 2014, with overwhelming 41.4 per cent share of transport, 26.3 per cent residential sector, and only 15.5 per cent of industry consumption share (International Energy Agency 2017b).

2.2.3 Algeria: export

Algerian energy sources (oil and gas) exports provide significant profits for the country's economy. In 2015 Algeria's energy industry generated $37.7 billion in revenues; however the country has been experiencing a decrease from $59.9 billion in 2010 with annual rate – 9.1 per cent. 41.7 per cent of the 2015 total export was represented by petroleum gas, followed by crude petroleum wit 32.8 per cent share of total Algerian export. Refined petroleum accounted for just 19 per cent and coal tar oil 1.4 per cent share of total export of the country (The Observatory of Economic Complexity n.d.-a).

The main energy sources export partners for Algerian products in 2015 were Spain with 18 per cent share of total export ($6.69 billion), France with 12 per cent share ($4.41 billion), Italy with 9.2 per cent ($3.47 billion), the United States with 7.6 per cent ($2.85 billion), the United Kingdom with 6.7 per cent ($2.52 billion), and Turkey with 5.9 per cent ($2.2 billion) (The Observatory of Economic Complexity n.d.-a).

2.2.4 Egypt: production

Egypt is considered to be the largest non-OPEC oil producer and the second largest natural gas producer in Africa (following Algeria) (U.S. Energy Information Administration 2015). The country's energy production is dominated by fossil fuels (oil and natural gas), with 4.4 billion barrels of proven reserves of oil as of 2015 (Index Mundi n.d.) and 1846.3 billion cubic meters of proved natural gas reserves as of 2014 (World Energy Council n.d.). It has the world's 16th largest gas reserves and is the 15th largest producer of natural gas (Adel 2016).

Egypt has long been a major producer of energy sources in the region. It was able to produce enough oil for domestic demand however the situation changed in 1990s. Furthermore, since 2006 Egypt had significant problems with covering the domestic demand of natural gas in spite of the new discoveries (with the exception of 2008-2011 period) (Hegazy 2015).

Egypt's renewable energy production remains undeveloped. Despite its vast solar and wind power generation capabilities, the generation of hydro power remained at 1202 ktoe (1.49 per cent), geothermal, wind, and solar power

production constituted 134 ktoe (0.16 per cent), and biofuels and waste accounted for 1737 ktoe (2.16 per cent) in 2014 (International Energy Agency 2017c). The country's nuclear power project has received a tender from Russian nuclear company Rosatom to try to address the growing Egyptian energy demand, but until today there is no nuclear energy facility operating in the country (Aljazeera 2016).

2.2.5 Egypt: consumption

On a pair with being the largest producer of energy sources, Egypt is also the biggest consumer of oil and gas in Africa. In 2013 its consumption constituted 20 per cent of petroleum and other liquids and 40 per cent of dry natural gas consumption in Africa (U.S Energy Information Administration 2015a). In 2014 the country's total final energy consumption constituted 51280 ktoe, with industry accounting for 25.6 per cent (13178 ktoe), transport likewise accounting for 25.3 per cent (13021 ktoe), residential sector – 23.1 per cent (11871 ktoe), and agriculture and forestry with 4.8 per cent (2503 ktote) (International Energy Agency 2017c).

Egyptian energy mix consists mainly of hydrocarbon resources (94 per cent) in 2013. The largest share belongs to natural gas (53 per cent), followed by oil with 41 per cent. Hydropower constituted only 3 per cent share, coal – 2 per cent, and renewables insignificant 1 per cent. However, Egypt's energy mix has been significantly changing over time. In 1970s hydropower accounted for 60 per cent, while natural gas consumption rose from 0 per cent in 1970s to 75.8 per cent in 2012 (Oxford Business Group n.d.).

Similarly to Algeria, Egypt is struggling to cover the rapidly growing domestic energy demand. According to World Bank Egypt is an inefficient country – its energy intensity is four times higher than in industrialized countries (Oxford Business Group n.d.). The prompt growth has been caused mainly by industrializing and increasing industrial output, energy-intensive oil and gas projects, economic growth, generous energy subsidies, and population growth (U.S. Energy Information Administration 2015a).

2.2.6 Egypt: export

Until 2010 Egypt's energy exports generated revenues for the economy in average around $4 billion (Hegazy 2015). However, as a result of growing energy consumption and production decrease, the country's total natural gas exports have been declining of approximately 30 per cent annually from 2010 to 2013 (U.S. Energy Information Administration 2015a). During the five year period (2010-2015), Egypt's revenues decreased from $34 billion to $27.7 billion (The Observatory of Economic Complexity n.d.-b).

Egyptian government has been forced to turn the natural gas supply away from export and direct the country's gas supply to the domestic energy market. As a result of a growing consumption, government reforms, and potential for exploration domestic demand is competing with the exports, predominantly in the electricity sector (U.S. Energy Information Administration 2015a). However, the 2015 exports are led by crude petroleum with 16.5 per cent of the total Egypt's export, followed by refined petroleum accounting for 3.66 per cent share (The Observatory of Economic Complexity n.d.-b).

Most of the Egyptian crude oil export is directed to the EU. In 2015 Egypt exported 23 per cent of crude oil to Germany, 20 per cent were directed to Italy, 11 per cent to Greece, and the rest approximately 10 per cent was exported to the UK, France, Spain and other countries of EU-28. 19 per cent was directed to India and 11 per cent share of total crude oil export is accounted for China. Most of the exported refined petroleum export was directed to the Asian counties, while most significant share of the refined petroleum export to EU is accounted for Italy (12 per cent), Spain (4.2 per cent), and Slovenia (3 per cent) (The Observatory of Economic Complexity n.d.-b).

2.2.7 Libya: production

Libya is a holder of the largest proved crude oil reserves in Africa, and the 9th in the world (Nagraj 2013), with the estimated proven reserves of 48.3 billion barrels (OPEC 2016). The country is also rich in natural gas – with proven reserves of 1504.9 billion cubic meters it is the 5th largest holder in Africa and the 21st in the world (Central Intelligence Agency 2016).

Since Libya joined the OPEC, its production of oil has been largely controlled by OPEC quotas. The production remained relatively high, following the global demand until 2011 when civil war came. In 2011 the production declined immensely to 26061 ktoe (comparing to 2010 pre-conflict production of 89842 ktoe). Although in 2012 the production recovered almost to the pre-war level (76651 ktoe), the trend has been declining ever since – Libya produced 53035 ktoe in 2013, 25949 ktoe in 2014 (International Energy Agency 2017d). Opposing the predictions of the experts, Libya's production has recovered in recent months to 885000 barrels a day in June 2017, almost 3 times the production of 2016 (Krauss 2017). However until today increasing the stagnating production, is the greatest challenge for the country, trapped into the situation with weak government, strong proliferation of armed groups (including ISIS), and financial challenges (Holodny 2016).

As in the case with Libyan natural gas production, the significance of the sector is considerably smaller than it is for oil production. Before 2003 development of the western Libya gas Project and 2004 opening of Greenstream pipeline to Italy Libya was consuming most of its natural gas itself. However, afterwards the country exported about a half of its natural gas production (with the exception of year 2011, when both oil and gas production and exports considerably dropped) (U.S. Energy Information Administration 2015b).

Giving the country's geographical location Libya has vast potential in renewable energy production (especially solar and wind). Nevertheless the number of current projects has been suspended or delayed due to inadequate planning (Khalil, Asheibi 2015), and the total primary energy supply of renewables in energy mix equaled 0 in 2014. Similarly, other energy sources were largely neglected in the county's energy mix (hydro and nuclear), while biofuels and waste accounted for just 0.84% of energy production in 2014 (International Energy Agency 2017d).

2.2.8 Libya: consumption

Libya's economy is dominated by the fossil fuels. According to the World Bank, fossil fuel energy consumption constituted 99.11 per cent of total energy consumption (Trading Economics n.d.).

In 2014 Libya consumed 220.000 barrels per day of petroleum and other liquids, most of which came from domestic refineries. Same year the country consumed 141 221 billion cubic feet of natural gas, which is slightly more than half of the total production (U.S Energy Information Administration 2015b).

The country's total final consumption was 9340 ktoe in 2014. Transportation accounted for 68.1 per cent (6334 ktoe) whilst the residential sector accounted for 11.7 per cent (1096 ktoe) and the industry amounted to just 8.1 per cent (759 ktoe). Less significantly, commercial and public services accounted for 3.5 per cent and agriculture constituted for 1.1 per cent (International Energy Agency 2017d).

Despite the high electrification rate – 98.4 per cent in 2014 – and electricity generation growth from 2000 to 2010, Libya experiences regular power shortages (U.S Energy Information Administration 2015b). Due to the country's high dependency on fossil fuels, the government is making efforts to diversify Libyan energy mix by committing to generate 7 per cent of electricity generation with renewable sources by 2020 (Regional Center for Renewable Energy and Energy Efficiency n.d.). However, the entire sector is considered to be problematic due to the consequences of the civil war, political instability and existence of armed groups, lack of strong government, and international sanctions.

2.2.9 Libya: export

Exploration of the Libyan hydrocarbon reserves has started in late 1950s and within several years it became an important oil producing country. However the international sanctions during 1980s and 1990s over Libyan suspected terror links had significantly hampered the development of the energy sector. The ending of sanctions in 2004 exempted the Libyan oil and gas export potential, and many international energy companies signed contracts to develop the country's resources (Bahgat 2010: 48).

As was mentioned above, Libya's natural gas export had not had any particular significance before opening the Greenstream gas pipeline to Italy in 2004. Since then, roughly half of the Libyan gas production is directed to Italy. After the outbreak of the civil war oil and gas exports have decreased, however the liquefied natural gas (LNG) export has been damaged immensely. Libya was

among the first states to explore LNG, and it was exporting a small amount to Spain in past, but after a damage of the LNG plant caused in early 2011 Libya has not been able to renew its export (U.S Energy Information Administration 2015b).

In 2015 Libya's export revenues amounted $8.78 billion, which is fivefold as less as the pre-war export profit (in 2010 it constituted $45.1 billion). During the period from 2010 to 2015 exports have been decreasing with the annual rate of -28 per cent. Crude oil petroleum is dominant in the 2015 Libyan export (69.2 per cent), petroleum gas amounted for 21.5 per cent, and refined petroleum accounting for 3.7 per cent of total export (The Observatory of Economic Complexity n.d.-c).

80 per cent of the Libyan crude petroleum export in 2015 was directed to the EU (Italy – 24 per cent, Germany – 20 per cent, France – 13 per cent). 14 per cent is directed to China. As with natural gas – 99 per cent is exported to Italy. Libyan refined petroleum export was directed mainly to the EU (Italy with 22 per cent, Spain with 21 per cent, and Greece with 5.4 per cent). Largest non-European importer was the US with 24 per cent of total refined petroleum export (The Observatory of Economic Complexity n.d.-c).

2.3 Energy relations between EU and NA

Geographical position has laid the foundation for centuries-long shared history of Europe and South Mediterranean region. However, the political and socio-economic cooperation between the European Union and its close North African neighbors was first institutionalized in mid 1990s in the so called Barcelona Process (Bahgat 2010: 44). The starting point of the Euro-Mediterranean partnership was in 1995, at that time when 15 EU countries, 5 non-EU countries (Croatia, Cyprus, Malta, Macedonia, and Turkey), and 12 Mediterranean countries (Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Syria, Tunisia, and Palestinian Authority) signed the Barcelona Declaration. The established objectives for the partnership were: (1) political and security partnership in order to promote emergence of peace and stability, (2) economic

and financial partnership to create a shared prosperity and the gradual establishment of a free-trade area, and (3) social, cultural and human partnership designed at encourage understanding between cultures and exchanges between societies (EUR-Lex 2011).

The cooperation was re-launched in 2008 as the Union for Mediterranean (UfM). The new partnership was created to establish more operational relationship within the region and offers three main benefits: (1) new impulse in political cooperation through organizing biennial summits of the heads of the states, (2) joint presidency of European countries and non-EU countries, and (3) promotion of projects supporting regional unity (Bahgat 2010:45). UfM included 28 EU member states, 4 non-EU countries (Albania, Bosnia and Herzegovina, Monaco, Montenegro) and 11 Mediterranean states (Algeria, Egypt, Israel, Jordan, Lebanon, Mauritania Morocco, Palestine, Syria, Tunisia and Turkey). Libya is not a part of the agreement, and has only observer status (European Union External Action 2016).

In parallel to the Union for Mediterranean, North Africa is part of the European Neighbourhood Policy (ENP). The program has been launched in 2003 to promote stability in the neighboring Eastern and Southern neighbors of the EU. Following the Arab Spring uprisings, ENP was revised in 2011 – the new objective of the initiative is the political, economic, and security stabilization of the region. Partners of the European Neighbourhood Policy are eligible for funding mainly via bilateral cooperation (European Commission 2016a).

Along with the network of broad partnerships European Union is developing bilateral agreements with the countries of the region. Algeria has signed the first partnership agreement back to 1976, which was replaced by the Association Agreement in 2005. The partnership is based on the systematic political dialogue, free trade, promoting private investment and job creation sustainable economic growth, social development, cultural exchange, and consolidation the rule of law. Energy was a part of a wider socio-economic cooperation until 2015, when EU and Algeria established a political dialogue on energy matters. The initiative was created to strengthen the cooperation on natural gas, renewable energy, energy efficiency, energy market integration and

infrastructure development (European Commission 2015). Under the ENP in 2015 Algeria has received €17 million to supplement the Algerian government's efforts to diversify the economy and improve the business climate and €10 million in 2016 to advance renewable energy and energy efficiency (European Commission 2016b). Following the political dialogue on energy matters, the first EU-Algeria business forum was established in May 2016. The forum promoted the energy trade partnership as well as cooperation in Algerian renewable energy development plan (European Union Newsroom 2017).

In case of Egypt, the legal basis of the EU-Egypt relation was signed in 2001 (came into force in 2004), which paved the way for bilateral agreement in 2007 (European Commission 2016c). The EU-Egypt Action Plan promotes a deeper economic integration, peace and stability, political, social and cultural cooperation, as well as aims to enhance security, growth, development and prosperity. Additionally, the two partners signed the memorandum of understanding to enhance energy cooperation in 2008. It aims to (1) support Egypt's energy market reforms and convergence of the energy market, (2) promote of renewable energy and energy efficiency, (3) back the development of energy networks, and (4) boost technological and industrial cooperation (Bahgat 2010: 45).

Similarly as Algeria, Egypt has been benefiting from the ENP. In 2015 the country had received €105 million funding for, among other social projects, promotion reforms in the Egyptian renewable energy and water sectors through developing capacity building; developing 200 MW Wind Farm project Gulf of Suez; and implementing the Sustainable Energy Finance Facility. A year earlier Egypt also received €115 million for implementing 3 programs, 2 of which were directed on developing the country's energy sector (European Commission 2016c).

Libya is a subject of a special case. As mentioned in section 2.2.9, for most of the time during 1990s and 2000s it was under international sanctions, which led to the underdeveloped relations with the EU. In researches completed before 2011 the authors express anticipation of the forthcoming deepening of the energy relations between the European Union and Libya (Bahgat 2010), however the

future events proved to change the direction of the EU-Libyan relations. At a present day, Libya is the only country of the region which does not participate in UfM, nor does it have an association agreement with the EU and thus, it is not able to participate on ENP. Although Libya remains eligible for the European Neighbourhood Instrument funding (ENI), it is mainly directed for stabilizing the country's political situation and supporting civil society (European Commission 2016d).

3. Existence of interdependence

Having investigated the European Union and North African energy security and the state of the EU-NA relations in energy sector, it is essential to examine the existence of energy relation interdependence to verify the hypothesis 1. The analysis will be conducted in accord with the Mikko Palonkorpi's criteria of ascertainment of the dependent nature of a trade relation as described in the first section of this thesis (Palonkorpi 2006). In case of a successful detection of a two-way dependent relation between the EU and three North African states (Algeria, Egypt, and Libya), the analysis will advance to the second stage (measuring the type of the interdependent relationship) in the fourth section of the thesis.

3.1 Importer EU

In order to evaluate the energy trade dependency of the EU on North Africa (particularly Algeria, Egypt, and Libya), the examination of the (1) energy trade balance, (2) level of domestic energy resources and (3) possibilities for diversification of energy supplies needs to be conducted (Palonkorpi 2006: 3).

European Union is one of the biggest importers of energy sources in the world. Not surprisingly, the European energy trade balance is negative for all of the 28 member states. In 2016 the net trade balance of energy products (expressed as percentage of GDP) fluctuated from 0.0 per cent in Denmark to -9.8 per cent in Malta, with average for whole EU is -2.03 per cent (Eurostat 2016d).

As for the oil reserves, at the end of 2016 European Union accounted for 0.7 thousand million tones, or 0.3 per cent of total world proven oil reserves. Proven reserves of natural gas were estimated for 45.3 trillion cubic feet, which constituted 0.7 per cent of world's proven reserves. Coal reserves accounted for 74819 million tones, or 6.6 per cent of total world reserves (British Petroleum 2017b).

Given the relatively small amount of EU oil imports from the North African region (Algerian oil constituted 4.2 per cent of total energy imports in 2014) and extensive diversification of suppliers and routes it is possible to conclude that in case of a disruption of North African oil supply EU would handle the situation successfully. In case of natural gas, EU-28 imports 12.3 per cent of the total natural gas imports from Algeria and 2.1 per cent from Libya (European Commission 2016e). Similarly, the gas imports from the region are not significant enough to cause a major blackout in case of a disruption of supply. North Africa is predominantly seen as a possible option for breaking out of the European Union gas dependency on Russian supplies (Belkin, Nichol, Woehrel 2013).

3.2 Exporter NA

Similarly to the evaluation of the importer's dependency, the evaluation of the exporter's dependency on the energy trade will be conducted through three indicators: (1) the ratio of income of the oil and gas exports to GDP formation, (2) the ratio of income of energy raw materials export to government budget, and (3) the ratio of the energy export revenues to the total export (Tichý 2011). Since North Africa is not a single political unit, the states' dependency will be evaluated separately.

Algeria

In spite of the government's attempts to drive the economy away from the energy resources export, Algeria's economy remains highly dependent on it. Income of the oil and gas exports accounts for up to 30 per cent of the country's GDP formation. With the GDP amounting $164.80 billion in 2015 (Trading Economics n.d.-b), the total energy commodities export accounted for roughly $49.44 billion. At the same time according to the U.S. Central Intelligence Agency, oil and gas exports pay for 60 per cent of Algeria's state budget (Central Intelligence Agency 2017a). As for the share of the energy export revenues in total export of the country, in 2015 total export revenues amounted $37.7 billion. 94 per cent of the export revenues accounted for petroleum gas (42 per cent),

crude petroleum (33 per cent), and refined petroleum (19 per cent) (The Observatory of Economic Complexity n.d.-a).

Egypt

Taking into account Egypt's unstable political situation and growing domestic demand, the country's energy sources export remains low. With the GDP of $1.105 trillion in 2015 (Central Intelligence Agency 2017b), the export of mineral fuels including oil accounted for $3.2 billion (World's Richest Countries n.d), or 3.45 per cent of the country's GDP. In past the energy sector generated big revenues for the state's budget – 9 per cent surplus in fiscal year 1991/92, but in 2003/04 it declined to just 3 per cent (International Business Publications, USA 2015: 79). Egypt's total export in 2015 amounted $27.7 billion. The export was led by crude petroleum (16.5 per cent), refined petroleum (3.66 percent), natural gas accounted for just 0.93 per cent of export. In total hydrocarbon resources accounted for 21.09 per cent of Egypt's export in 2015 (The Observatory of Economic Complexity n.d.-b).

Libya

Much like Algeria, Libya is reliant on hydrocarbon export. The country's GDP is almost entirely dependent on oil and gas exports, so when the civil war erupted and production declined, the country suffered from huge losses. In 2015 Libyan GDP amounted $29.15 billion (Trading Economics n.d.-c). Income from oil and gas exports constituted 94.4 per cent of total exports and accounted for approximately $8.2 billion (The Observatory of Economic Complexity n.d.-c). Thus, the oil and gas exports constituted 28.1 per cent of the Libyan GDP formation in 2015. As concerning the government revenues, energy raw materials sector represents approximately 93 per cent of government budget (World Bank 2006).

Ultimately, the research has shown minor EU dependency on the North African energy commodities import. European Union diversification strategy allows it to combat the disruption using market-based approach, sharing responsibility, and cooperation (European Commission 2014b). Contrawise, North African states are dependent on energy commodities exports to the European

Union in varying degree. Although Egypt's economy relies on energy sector in the smallest degree out of the three examined cases, the country's export to the EU is still dominated by energy commodities (European Commission 2017c). In case of Algeria, the high level of economy's dependency on the European export (which accounts for approximately 50 per cent) prevails, despite the government attempts to lessen the energy export dependency. Finally, Libya retains the highest level of mineral fuels export dependency of economy, with more than 80 percent of products being exported to the European Union member states. Hence, it is possible to conclude, that the dependency of the EU and North Africa exists in varying degrees.

4. Measurement of interdependence

Since the existence of the two-way energy trade dependency between the European Union and North Africa has been proven in the previous section, it is now possible to determine the type of the interdependence and measure its extent. The calculation will be made using the method defined by R. Emerson and mathematical formula developed by K. Barbieri, which were described in the first section of the thesis.

As stated by Emerson, the power of the European Union over North Africa (PEU-NA) resides indirectly in the North African dependency on the European Union (DNA-EU). The power-dependency relation can be expressed as:

$$P_{EU\text{-}NA} = D_{NA\text{-}EU}.$$

Simultaneously, the power of the three North African states over the European Union ($P_{NA\text{-}EU}$) is equal to the dependency of the European Union on North Africa ($D_{EU\text{-}NA}$). This relation can be expressed as:

$$P_{NA\text{-}EU} = D_{EU\text{-}NA}.$$

After the expression of the power-dependency relation of the European Union and North Africa in this way, it is now possible to determine whether the interdependent relationship can be characterised as symmetrical or asymmetrical and which actor benefits the most (to put it in other way, which of them is more powerful within the dyadic relation). To evaluate the type of interdependence it is necessary to compare the trade share of the dyadic trade relationship in energy sector of the EU to the trade share of Algeria, Egypt, and Libya (with the score close to 1 representing the higher importance of the relation for the actor, and score close to 0 lower level of importance respectively). The calculation will be made for each of three North African states separately. All of the used data is of 2015.

Algeria

Dyadic trade EU-AL = 22,042,802,639 USD (Trading Economics n.d.-d)

Total trade EU = 381,210,000,000 USD (Trading Economics n.d.-e)

Trade share EU = **0.057**

The equation represents relative importance of the actor on the dyadic trade. The score fluctuates from 0 to 1, with higher score representing bigger relative importance and lower score smaller relative importance of the trade for the given actor. Having calculated the EU trade share of import from Algeria in energy sector relatively to its total import of energy commodities, it is evident that the relative importance of the trade relation between EU and Algeria is rather minor.

Dyadic trade AL-EU = 22,042,802,639 USD

Total trade AL = 33,350,000,000 USD (Trading Economics. n.d.-d.)

Trade share AL = **0.66**

In case of Algerian trade share, the calculation shows that unlike for the European Union, the trade in energy sector plays a relatively significant role for the state.

Symmetry EU-NA = $1 - \left| 0.057 - 0.66 \right|$ = **0.397**

The score of the symmetry equation represents the level of equality (symmetry) in the dyadic relationship. The score fluctuates from 0 to 1, with higher score representing a higher symmetry, and lower score, respectively, the higher level of asymmetry. In case of EU-Algerian trade relationship in energy sector, it is obvious that the relation is rather asymmetrical.

Egypt

Dyadic trade EU-EG = 1,256,750,000 USD (Trading Economics n.d.-f)

Total trade EU = 381,210,000,000 USD

Trade share EU = **0.003**

In case of the EU-Egyptian energy trade relationship, the calculation shows even smaller relative importance of the trade for the European Union, than it was in the EU-Algerian trade relationship. The negligible score of just 0.003 showcases the EU's minimal significance of the energy commodities import from Egypt.

Dyadic trade $_{EG\text{-}EU}$ = 1,256,750,000 USD (Trading Economics n.d.-g)

Total trade $_{EG}$ = 3,230,000,000 USD (Trading Economics n.d.-g)

Trade share $_{EG}$ = **0.389**

As for Egypt, the calculation shows that the energy commodities export plays moderate role for the state. The result is not surprising taking into account the country's small export of energy commodities due to the rapid growth of domestic demand.

Symmetry $_{EU\text{-}EG}$ = $1 - \left| 0.003 - 0.389 \right|$ = **0.614**

The calculation of symmetry shows the relatively high result – the score of 0.614 represents moderate asymmetry in the EU-Egypt energy trade relation. The result might be due to the facts, that EU imports a minor amount of energy commodities from the country, and Egypt is currently exporting smaller amounts of energy products.

Libya

Dyadic trade $_{EU\text{-}LI}$ = 4,844,000,000 USD (The Observatory of Economic Complexity n.d.-c)

Total trade $_{EU}$ = 381,210,000,000 USD

Trade share $_{EU}$ = **0.012**

Similarly to the 2 previous cases, the significance of the EU energy trade with Libya is not particularly great. Due to its diversification programmes and small amount of the Libyan exports, the score remains low.

Dyadic trade $_{LI\text{-}EU}$ = 4,844,000,000 USD

Total trade $_{LI}$ = 8,289,000,000 USD (The Observatory of Economic Complexity n.d.-c)

Trade share $_{LI}$ = **0.584**

As for the Libyan case, the importance of the energy exports to the EU is much greater. The calculation shows, that relatively small Libyan energy commodities exports play a moderately significant role for the state.

Symmetry $_{EU\text{-}LI}$ = 1 – $\left|\ 0.012 - 0.584\ \right|$ = **0.428**

The equation of symmetry showcases a rather asymmetrical nature of the EU-Libyan energy trade relationship. Even during the Libyan energy commodities exports rapid decline due to its unstable political and security state, the country remained dependent on the energy trade. The rise of the energy commodities production may escalate the dependency further. This condition puts Libya into a relatively unfavorable position and therefore weakens an already fragile state.

To sum up, the measurement has proven the existence of an asymmetrical nature of the energy trade between European Union and North Africa. Using the Emerson's method the relation can be expressed as:

$$P_{EU\text{-}NA} = D_{NA\text{-}EU}$$

$$\vee \quad \vee$$

$$P_{NA\text{-}EU} = D_{EU\text{-}NA}.$$

Due to EU's relatively small import from North Africa, the measurement has shown that the European Union is dependent on the North African energy to a small extent. At the same time, higher scores of asymmetry for Algeria, Egypt, and Libya showcase that the countries are reliant on EU energy exports (Table No. 1).

Table No. 1. Trade share and symmetry calculation results

	Trade share EU	*Trade share X*	*Symmetry EU-X*
Algeria	0.057	0.66	0.397
Egypt	0.003	0.389	0.614
Libya	0.012	0.584	0.428
Average NA	**0.024**	**0.544**	**0.479**

Source: author.

Therefrom power of the European Union over North Africa is equal to the North African dependency on the European exports, and controversially, power of the North Africa over the European Union is equal to the dependency of the EU on three North African states. However, the power of EU (and dependency of North Africa) is much greater, than the power of NA (and dependency of EU). The average symmetry score for North Africa is 0.479, which represents the higher level of asymmetry within the EU-NA energy relation. Thus, it is possible to conclude, that European Union has more power over its trade partner, while North Africa is a more dependent partner of the dyadic trade.

Conclusion

Energy is one of the most important elements for the survival of the states. In the modern age, the entire economies of all the countries are vastly reliant on sufficiency of the energy resources, making it a vital recourse not only for the industry and economy expansion, but the political stability as well. However, the distribution of energy sources is not equal, which puts some of the states to a rather unfavorable position. Due to its huge influence on the internal life of the states, energy has become one of the strongest triggers of both domestic and foreign policies.

This work was aiming to analyse the energy relation between the European Union and three North African energy commodities exporters (Algeria, Egypt, and Libya) under the prism of the neoliberal theory of interdependence. The result showcases the European Union and North African position within the dyadic energy trade relationship and therefore provides an outlook on the future development of the relation between the actors in energy sector.

The main objective (1) of the thesis was whether the relation between the European Union and three North African states can be characterised as interdependent. The research showed that even though all the three North African countries are currently experiencing the decline in export of energy commodities, mainly due to the internal political situation and growing domestic demand, the energy trade relation with the European Union still endures. Algerian, Egyptian, and Libyan economies are reliant on the revenues from the energy commodities export, which is directed mainly to the European countries. Thus, the North African dependency on the energy export to the EU is clear.

On the other hand, EU energy dependency on the North African imports plays not much of a significant role in its energy security. Considering the European Union vast energy demand, North Africa's decline in energy supply is seen as a way of diversification of the energy supply, the loss of which could be to some extent easily dealt with.

Although some countries rely on the North African energy export to a greater extent (such as Spain with 59.1 per cent of total petroleum gas import in 2015) (The Observatory of Economic Complexity n.d.-d), the implication of the EU energy regulations and principles of solidarity and cooperation would provide with the framework for unproblematic dealing with the disruption without greater losses for the economy (European Commission n.d.-a).

Having analyzed the aspects of energy dependency with the indicators developed by M. Palonkorpi (Palonkorpi 2006), it is possible to conclude, that the two-way dependency on energy trade relation between the European Union and North Africa exists. Since the hypothesis 1 (interdependence is present in the energy relation between the EU and North Africa) has been verified and the first objective proven, it is now possible to evaluate the second objective.

The second objective of the work (2) was to measure the type of the interdependent relationship between the European Union and North Africa. Using the methods of Richard Emerson (1962) and Katherine Barbieri (1996) the type of the interdependent relationship between the EU and three North African states individually was measured.

The method developed by R. Emerson showed that within the interdependent relationship between EU and North Africa, the power of the European Union over North Africa is equal to the dependency of the North Africa on the European Union. Controversially, the dependence of the European Union on North Africa equaled to the power of North Africa over the European Union. However, this did not mean that the power of the EU over NA and power of NA over EU were equal, which was displayed by the second part of the measurement.

The second part of the evaluation of the nature of the interdependent relationship between the European Union and North Africa was calculated using the method developed by K. Barbiery. The equation showed the relative importance of the trade partnership for each actor, which were then used to measure the (a)symmetry of the relation. Since North Africa is not a single political unit, the measurements were conducted separately, and the average score for North Africa was derived from separate scores of Algeria, Egypt, and Libya.

The results in all three cases showed the relatively low level of significance of the relation for the European Union (0.057 with Algeria, 0.012 with Libya, and only 0.003 with Egypt). The outcome is not surprising taking into account the relatively small amount of imports of energy commodities from the North African region and high energy demand within the EU. The average score of the European Union is 0.024, which represents a very low overall importance of the trade with North Africa.

As for North Africa, the significance of the energy commodities trade with the EU is much higher. Egyptian score of trade share was the lowest – 0.389, however taking into account unstable export due to the rapid domestic demand growth, the number could shift significantly in the nearest future. Libyan score of the trade share was 0.584, which represents a medium importance of the energy export to EU. But it is important to notice, that similarly to Egypt, the country's export (and production) is immensely unstable since the beginning of the civil war, and therefore the score could change enormously with the development of the situation in the country. Algeria has received the highest score out of all actors – 0.66, which represents a fairly significant level of importance of the energy trade relation with the European Union for the country.

Finally, the last stage of the measurement showcases the symmetry or asymmetry of the energy trade relation between the EU and NA. The average score of symmetry for EU-NA relation is 0.479, which represents fairly asymmetric type of interdependent relationship. The highest score i.e. the most symmetric nature of relationship achieved Egypt; however 0.614 is by far not what an ideal symmetry is. The symmetry in an EU-Libyan relationship was measured as 0.428, which represents a fair asymmetry in the trade relation. Yet again, the number could fluctuate significantly if Libyan production was less unsteady. As for Algeria, it received the lowest score of symmetry – 0.397, which shows the high level of asymmetry in its energy relation with the European Union, despite the government attempts to diminish Algerian dependency on energy sector.

Hence, the second hypothesis (the interdependence can be characterised as asymmetrical and the position of the EU in it is more advantageous) has been

proven. Ultimately the research has shown a substantial asymmetry in an interdependent relationship between the European Union and North Africa. The power of the European Union over its neighbor, which is defined by the opportunity of the potential influence, defines the relation between them (Emerson 1962: 32).

The thesis has defined the nature of the relationship between the European Union and North Africa in energy sector as asymmetrically interdependent, with the European Union acquiring significantly more power and influence over North Africa. Using its influence, the EU is able to create the framework and favorable conditions for the cooperation, and therefore enhance energy security of the region.

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