

## Bulgaria's energy security in the context of energy dependence on the import of oil products

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### Abstract

*Over the years Bulgaria has remained strongly dependent on its import of oil products mainly due to the lack of oil resources on its territory. This import dependence poses a significant risk for the country's energy security. In this research we analyse Bulgaria's energy security in terms of its dependence on the import of oil products. For the purposes of this research on the energy dependence we estimated the degree of Bulgaria's dependence on the import of oil products it needs, as well as the degree of import diversification in terms of the number of suppliers and the diversification index. The results show an interesting trend – despite the large number of suppliers, the diversification index remains at levels that pose high risk for the energy security of the country.*

**Keywords:** Bulgaria's energy security, energy, import dependence, diversification index, oil products

### Introduction

In recent years the issues of energy security and energy dependence have been subject to heated debates due to their importance for the normal development and functioning of national economies. It is an undeniable fact that in the twenty-first century the energy sector affects both the everyday lives of the ordinary people and the industry to such an extent that economies cannot exist without such a sector. The importance of the energy sector makes all countries consider the issues of their energy security and the reliability of their energy supply.

Bulgaria does not have significant sources of oil or natural gas in its territory. This is why it has to meet its energy needs by importing energy from other countries. The continual import spins the country in the spiral of energy dependence on the import of oil products, which negatively affects its economy. The high dependence levels affect the overall economic stability of the country as well.

This research aims to determine the effects of the import of oil products and the degree of diversification of energy supplies and suppliers for Bulgaria's national economy by analysing the factors that have negative effects on the energy security of the country.

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The structure of the research paper follows the logic which would reveal most completely Bulgaria's position in terms of the country's energy dependence and security. To do this the author had set the following goals:

- To define the term “energy security” (in Section 2);
- To define the methods that shall be used in this research (in Section 3);
- To survey the primary production (PP), the gross internal energy consumption (GIEC), the export and the import of oil products (in Section 4);
- To analyse the empirical results from the survey (in Section 5);
- To provide specific concluding remarks based on the research results.

## **1. Literature review**

### **1.1. Energy security context**

The topic of national energy security has been the focus of attention of many scholars for quite a while. Numerous research studies in this field have shown that it is a topical and complex issue of indisputable importance. The importance of energy security for each country is different and depends on the role of the state in the trade process (Müller-Kraenner, 2007). Exporting countries consider their energy security in terms of exporting their products on markets with good prices and minimal risk exposures. Importing countries consider their energy security in terms of reliable supplies at reasonable prices.

In his research Alhajji (5 November 2007) notes that governments often consider the energy security concept only in terms of oil products. This fact is not surprising, because oil products are a key resource for energy importers. This is why oil products have been a priority factor in defining energy security policies for a long time. Besides, most of the energy security literature is concerned exclusively with oil products (Fried and Trezise 1993; Stringer, 2008) since these products play the most important role in the global economy and trade (Noreng, 2002).

### **1.2. Import dependence context**

Energy dependence is usually considered the main factor that defines the level of risk for a country's energy security. Many authors relate energy security to energy dependence due to the effect of this type of dependence on the security of the national economy. The research studies in

this field were carried out using various research methods. Such an example is the research of Nicholas M. Odhiambo (2014), who studied energy security in the context of developing countries' energy dependence using an Autoregressive Distributed-lag (ARDL) - bounds Testing Approach. Kamonphorn Kanchanaa, Benjamin C. McLellan and Hironobu Unesak (2016) analysed the international dimension of energy security by compiling a composite energy dependence indicator.

The core of this research is based on the model adopted by the International Energy Agency (International Energy Agency, 2011) to evaluate energy security risks using a wide range of indicators. Indicators of key importance are the energy dependence and the diversity of suppliers, which is calculated using Herfindahl-Hirschman index, which is a measure of the concentration of supply. Our research is based on the same methodology for calculating these two indicators in order to determine their effect for Bulgaria's energy security.

## **2. Research methodology**

This research is focused mainly on Bulgaria's dependence on the import of oil products and its effect on the energy security of the country. The empirical analysis comprises two distinct stages - an analysis of Bulgaria's dependence on the import of oil products, followed by a study of the diversification of suppliers and supplies. It aims to determine the degree of the country's energy dependence and import structure and their effect on Bulgaria's energy dependence over a period of ten years from 2005 to 2015.

### ***Methods for evaluation of the energy dependency***

Energy dependency is evaluated using the methodology adopted by Eurostat. It is based on the ratio of the import of oil products to the gross inland consumption. This ratio shows the country's degree of dependency on imports to meet its inland consumption. The result is expressed as a percentage that shows the share of import in the inland consumption and is calculated using the following equation:

$$ID = (Import/GIEC) \times 100 \quad (1)$$

where:

ID is import dependence

Imports – the volume of imported oil products

GIEC- Gross Inland Energy Consumption of Oil Products

### ***Diversification index – methodology***

In this part of the study we analysed the structure of import in terms of the existing diversification of suppliers and supplies. The diversity of suppliers is calculated based on the number of suppliers for the corresponding year. The diversity of supplies is calculated using the Herfindahl–Hirschman index. This methodology is used by the International Energy Agency and is described in a brochure for the MOSES model (International Energy Agency 2011). The Herfindahl–Hirschman index is a measure of the concentration of supply and the existence of monopolistic markets.

$$HHI = \sum_{i=1}^N s_i^2 \quad (2)$$

This index is calculated by squaring the market share of the import of each firm competing in a market, and then summing the resulting numbers. Equation (2) can be expressed as:

$$HHI = s_1^2 + s_2^2 + s_3^2 + \dots + s_n^2 \quad (3)$$

where  $s$  is the market share of each firm.

There are two methods for calculating the market share and, respectively, for evaluating the index. The first method calculates the market share of the companies as a whole number (a percentage of the total market volume) and the squared percentage points are summed. When this method is used, HHI may reach a maximum of 10 000 units. All values below 1000 units mean that the market is highly diversified and a value of 10 000 means that there is a monopolistic market.

The second method uses market shares expressed as decimal fractions (rather than percentages) and the index is the sum of their squares. In this case the index ranges between 0 and 1 ( $0 < n < 1$ ), where a value of 0 mean that the market is highly diversified and a value of 1 means that there is a monopolistic market. The IEA categorizes the diversity of supplies based on the Herfindahl–Hirschman index into three ranges: high diversity; medium diversity and low diversity (International Energy Agency, 2011). According to this scale, all markets within the range of  $n < 0.3$  have high

diversity of supplies; those within the range of  $0.3 < n < 0.8$  have medium diversity of supplies and those with indices exceeding 0.8 have low diversity of supplies.

For our research we used the second method for calculating the Herfindahl–Hirschman index, which calculates the index using squared decimal fractions. Diversification is assessed using the scale adopted by the International Energy Agency (IEA). The results from the analyses of the import dependence, the number of suppliers and the Herfindahl–Hirschman's index show the effect of these factors on Bulgaria's energy security.

### **3. Characteristics of Bulgaria's Primary Production, Gross Inland Energy Consumption, Import and Export of Oil Products**

This section provides a review of the organization of the oil market and the four main indicators related to Bulgaria's production, consumption, import, and export of oil products. The aim of this review is to give us a general idea of the importance of oil products as an element of Bulgaria's energy mix. The indicators are reviewed in the following order: (1) primary production (PP) of oil products; (2) gross inland energy consumption (GIEC); (3) import; (4) export. First, however, we should consider the specific characteristics of the market for crude oil and oil products in Bulgaria.

Unlike the natural gas and electricity markets, the crude oil market in the country is fully liberalized. The companies operating on it are not owned or controlled by the state-owned Bulgarian Energy Holding (BEH).<sup>1</sup> Note that one of the biggest refineries on the Balkan Peninsula is located in Bulgaria. According to information<sup>2</sup> from the Ministry of Energy it is controlled with a majority stake by the Russian company Lukoil (Ministry of Energy 2015).

LUKOIL Bulgaria EOOD and LUKOIL Neftohim Burgas AD also operate on the territory of the country. Both companies are owned by the Russian company Lukoil. LUKOIL Bulgaria EOOD, which owns the Rosenets port terminal and a refinery, is the biggest company in Bulgaria. According to information published by the company itself, its contribution to the state budget is  $\frac{1}{4}$  of the total state budget revenue. The company is a major supplier and leader in the distribution of the fuels and petrochemicals produced by LUKOIL Neftohim Burgas AD. The latter owns of a large chain of gas

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<sup>1</sup> Bulgarian Energy Holding EAD is a holding company that owns companies specialized in production and transmission of electricity; transmission, transit and storage of natural gas, and lignite extraction. The Holding Group of BEH EAD holds a key position on the natural gas and electricity market in Bulgaria as well as in the region due to its export of electricity. The company is 100% owned by the Bulgarian state and is the largest state-owned company in the country in terms of own assets. Its ownership rights are vested in the Minister of Energy.

<sup>2</sup> This information is part of the Annual Bulletin on the Status and Development of the Energy of the Republic of Bulgaria. It is an official document disclosed pursuant to Art. 4, para. 2, item 17 of the Energy Act, which provides for the annual publication of this Bulletin.

stations on the territory of Bulgaria and has a large share of the market for fuels, petroleum products and polymers both in Bulgaria and in the Central and Eastern European countries.

Other companies that operate on the oil and oil products market are:

- PETROL AD - a private company, which is the leader in the distribution of fuels in the country. It owns more than 500 gas stations, 80 oil bases and three port terminals for petroleum products.
- PRISTA OIL AD - Bulgaria - the company is part of PRISTA OIL Group, which owns subsidiaries all over Europe and deals with production, distribution, sale and marketing of oils, greases, brake fluids and other oil products.
- NIS PETROL EOOD, owned by Neftena Industria Serbia (NIS) - one of the largest oil companies in Southeastern Europe. Note that *its majority shareholder (with a majority stake of 56.6% of its equity) is the Russian company Gazprom Neft*. In Bulgaria the company operates under the brand "Gazprom" and owns a number of gas stations under the same brand (Ministry of Energy, 2016).

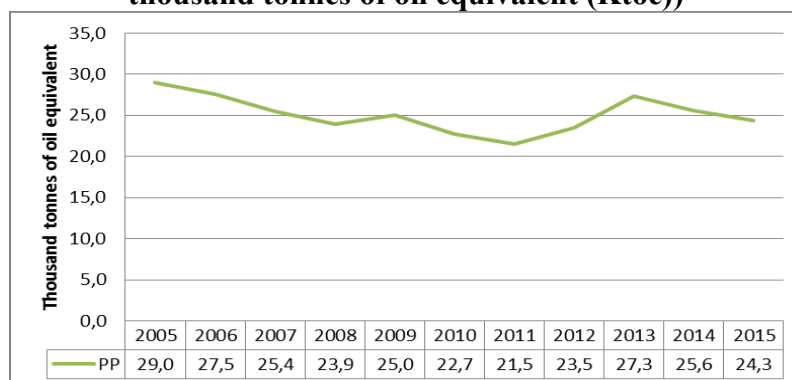
The market structure described above leads to the conclusion that the Russian Lukoil and its affiliated companies are leaders on the oil market in Bulgaria. Russia is the country's main supplier of crude oil because of the technological characteristics of the existing refinery in Bulgaria and the characteristics of the oil it processes. Note that the physical properties and the exact chemical composition of the crude oil vary depending on the location of the deposits. Therefore, oil refiners are adapted to a certain type of oil and must undergo certain technological modification in order to process other types of oil.

The output of Bulgaria's only refinery is essential for the energy security and stability of the country because of its market orientation. Despite the relatively small quantities of oil extracted on its territory, the country's market orientation is towards export of processed oil products. The uninterrupted supply of oil from Russia is essential for Bulgaria and its energy security. Its importance for the country's oil industry is analysed in the following sections.

### 3.1. Primary production of oil products

Bulgaria's deposits of oil and natural gas are insignificant and this is why the volume of its primary production of oil products is extremely low and cannot meet the demand for such products (see Figure 1).

**Figure 1. Primary production of oil products in Bulgaria in the period 2005-2015 (in thousand tonnes of oil equivalent (Ktoe))**



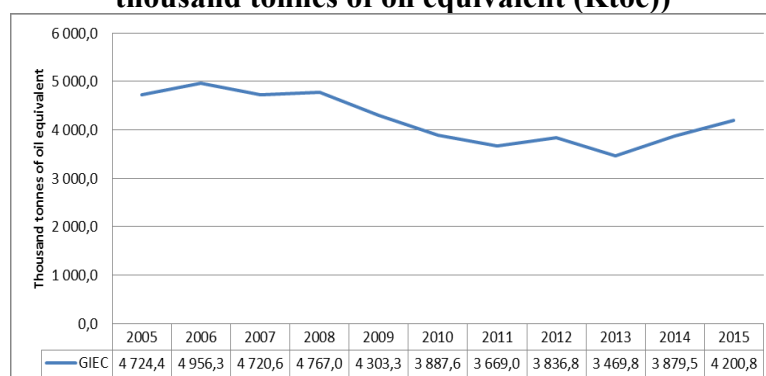
Source: Author's representation using data from Eurostat database

During the period (2005 – 2015) there was a steady downward trend in the production of oil products until 2011, followed in 2012 and 2013 by an increase that may be defined as insignificant, because the total volume of production increased only to 27.3 Ktoe.

### 3.2. Gross inland energy consumption

Bulgaria's inland consumption of oil products consists mainly of consumption of fuels. This is why GIEC<sup>3</sup> remained high, fluctuating between 3 669 Ktoe and 4 956.3 Ktoe (see Figure 2) between 2005 and 2015. Consumption was decreasing until 2013, and then started to increase quite rapidly to reach 3 879.5 Ktoe in 2014 and 4 200.8 Ktoe in 2015.

**Figure 2. Gross Inland consumption of oil products in Bulgaria in the period 2005-2015. (in thousand tonnes of oil equivalent (Ktoe))**



Source: Author's representation using data from Eurostat database

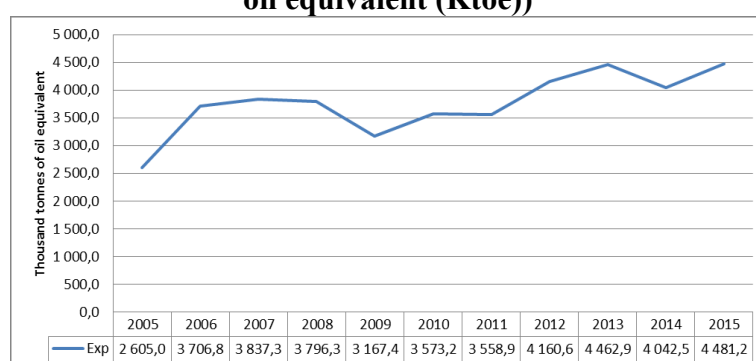
<sup>3</sup> GIEC – Gross Inland Energy Consumption

The comparative analysis of GIEC and PP<sup>4</sup> for each year shows that the country relies heavily on the import of oil products. The extremely low volumes of PP and the high levels of consumption show extremely high levels of import dependence and corresponding levels of risk for the energy security of the country.

### 3.3. Export

Export data show that the country exports large volumes of processed oil products (see Figure 3). Despite the low levels of primary production, the country specializes in the export of processed oil products (mainly fuels). The difference between the PP volumes and the export volumes is compensated with import of crude oil.

**Figure 3. Bulgaria's export of oil products in the period 2005-2015 (in thousand tonnes of oil equivalent (Ktoe))**



Source: Author's representation using data from Eurostat database

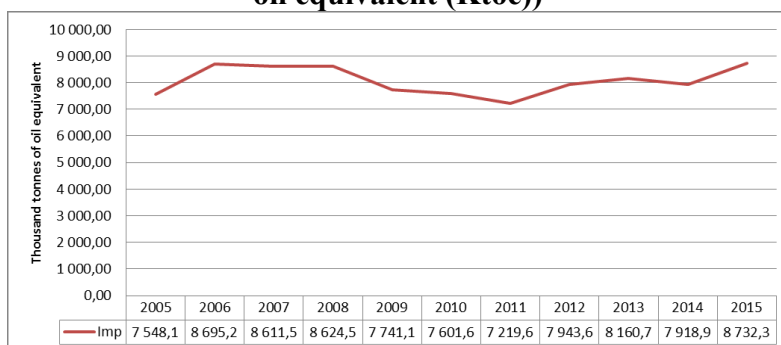
The export trend shows an increase in the exported quantities of oil products. The highest volume was being reached in 2015 (4 481,2 Ktoe) and the lowest volume in the export values was reported in 2005 (2605 Ktoe) and 2009 (3167.4 Ktoe). Despite this decline the trend remains growing. The increasing in the export values in the case of Bulgaria is a prerequisite for increasing in the quantities of the imports of oil products due to the low oil reserves.

### 3.4. Import

Taking into account the data for the PP, the GIEC and the export volumes, the volumes of import are predictably high because they have to cover the difference between the PP on the one hand, and the GIEC and the export of oil product, on the other. Imports peaked in 2015 at 8 732.3 Ktoe (see Figure 4).

<sup>4</sup> PP – Primary Production



**Figure 4. Bulgaria's import of oil products in the period 2005-2015 (in thousand tonnes of oil equivalent (Ktoe))**

Source: Author's representation using data from Eurostat database

According to the reported data, imports declined in two of the years within the analysed period – in 2005 (7548.1 Ktoe) and in 2011 (7 219.6 Ktoe.) The highest volume of imported oil products (8 732.3 Ktoe) was reported in 2015. The analysis of the import volumes shows that there is a trend of their increasing steadily over the period. Although rate of increase is categorized as moderate, the level of import volumes poses a risk for the energy security of the country.

#### 4. Empirical research results

This section presents the results from the empirical study. The analysis shows an interesting trend in terms of the percentile import dependence and the directly proportional relation between the number of suppliers of oil products and the diversification index. The results are shown in Table 1 below.

**Table 1. Bulgaria's Import Dependence, Number of Suppliers and Herfindahl–Hirschman's index for the period 2005-2015**

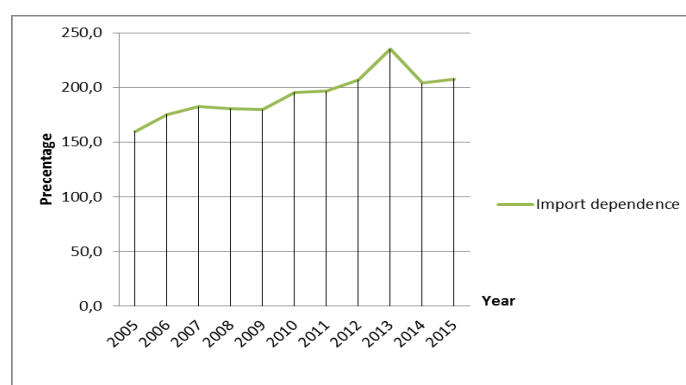
Year	Import Dependence	Number of Suppliers	Herfindahl–Hirschman Index
2005	159.8%	25	0.501
2006	175.4%	27	0.532
2007	182.4%	25	0.367
2008	180.9%	25	0.401
2009	179.9%	28	0.388
2010	195.5%	28	0.598
2011	196.8%	25	0.616
2012	207.0%	24	0.647
2013	235.2%	27	0.629
2014	204.1%	31	0.598
2015	207.9%	32	0.450

Source: Author's own calculations using data from Eurostat (<http://ec.europa.eu/eurostat/data/database>), retrieved on 27 March 2017

The results in the above table show that Bulgaria is highly dependent on its import of oil products with dependence levels reaching values of over 235% over the consumption in 2013. On the surface such large volumes of import may seem illogical and unjustified. However, they are justified by Bulgaria's orientation on the market of oil products. Despite its limited sources of oil, the country imports large volumes of crude oil products which are processed and exported as fuels.

The curve of the import of oil products peaked in 2013 and then went down again (Figure 5.) The increase of import dependence while the consumption is decreasing (Figure 5) is due to the increase of the exported volumes of processed fuels.

**Figure 5. Bulgaria's dependence on the import of oil products (2005-2015)**



Source: Author's own calculations

Although import dependence itself poses a risk for Bulgaria's energy security, this risk can be mitigated to levels that do not jeopardize the country's economy by means of diversification of its suppliers and supply. Note that these two terms are markedly different. From a theoretical point of view, in the presence of a large number of suppliers, there will be an almost symmetrical distribution of supply, which indicates a high diversity of supply. In this case, the risk has values that assign our country to the group of the countries with low dependency on supplier countries.

There is another scenario as well, in which the number of suppliers is also large, but the bulk of the import is concentrated in one or a few large importers and the other suppliers import insignificant or supplementary volumes. In this scenario, the risk for the country's energy security increases significantly. Depending on the degree of concentration of imports, the country can be placed in a situation that makes it highly vulnerable to suppliers of oil products.

The result of the research show that the number of Bulgaria's suppliers of oil products varies between 24 (in 2012) and 32 (in 2015.) This means that the level of diversification of suppliers of oil products is good. Therefore, the country's risk exposure should be defined by analysing its import

concentration, i.e. the diversification of supply. Bulgaria's Herfindahl–Hirschman index varies between 0.367 (in 2007) and 0.647 (in 2012.). According to the rating scale of the International Energy Agency (International Energy Agency 2011) these values rank as medium import diversification. The closer to 1 are the values of the index, the greater is the exposure to energy security risk of the country that imports the product. A high risk exposure means a higher dependence of the country on its suppliers. In this respect Bulgaria's risk exposure is relatively high, since about 77% of its oil products are imported by one supplier - Russia.

The high concentration of supply in terms of a single major supplier is a prerequisite for increasing both the energy and the economic risk for Bulgaria. Given the degree of energy dependence on Russia and the fact that it is a major supplier of oil to the Bulgarian refinery, we may conclude that our energy sector is highly vulnerable to external factors. Given the small quantities of oil extracted in the country, the disruption of supply would have a negative impact on consumption as well as the country's export of processed oil products. Accordingly, this would have a serious negative impact on the country's economic stability.

The high dependence on imported oil increases Bulgaria's susceptibility to foreign political and geopolitical pressure. The low degree of external resistance to such pressure poses serious risks for the country and all sectors of its economy in terms of pressure for adoptions of policies that are not in the best interest of the state. The pursuit of a policy contrary to the interests of the state is likely to generate negative effects on the sustainable development of the country's economy.

The above analysis shows that energy dependence is one of the key factors for determining the country's energy security and economic stability because the conditions of the energy sector affects all other sectors of our economy. At high levels of energy dependence, the risk can be mitigated to levels that do not jeopardize the country's energy security through diversification. Note that in order to mitigate the energy risk we need not only diversification of the suppliers, but also diversification of supplies. In some cases, as is the case with Bulgaria, the level of diversification of suppliers may be satisfactory, but the supply of a certain commodity may be concentrated in one or a few major suppliers while the rest import insignificant or complementary quantities. Diversification of suppliers is a misleading indicator because it may inadvertently conceal the presence of concentration of supplies. This in turn generates a hidden risk for the country. Due to the fact that the latter may remain covert, it may have a strong negative impact on the country's economy and its degree and importance may prove to be serious.

## Conclusions

The research analysed the effects of energy dependence and import structure on Bulgaria's energy security. The dependence was determined by calculating the ratio of energy dependence on the import of oil products to the consumption of such products in the period 2005 - 2015. Import structure was analysed using the number of suppliers and the degree of diversification in terms of the Herfindahl–Hirschman's index.

The results of this research show that Bulgaria is heavily dependent on imports of oil products, with the percentage of its dependence reaching levels that are twice as high as its consumption of such products. There are two reasons for this situation – the lack of significant oil deposits on the territory of the country and the fact that Bulgaria exports large amounts of the imported oil product as processed fuels.

The analysis of the diversification of suppliers and the diversification of supply shows that despite the large number of suppliers of oil products, the import structure is not diversified sufficiently. This means that import is concentrated in one or a few large importers while the other suppliers import insignificant or supplementary volumes of oil products. This import structure places Bulgaria in a vulnerable position as it depends on just one main supplier, which poses a significant risk for the energy security of the country. Taking into account the degree of dependence on the import of oil products as well, we may conclude that Bulgaria is exposed to a significant energy security risk in terms of its import of oil products – a situation that calls for a careful risk management and re-considering of the import structure.

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