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## Assessment of Lithuanian Energy Sector Influence on GDP

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### ABSTRACT

The relationship between the Economic growth and Energy Sector performance is unquestionable. However it is not an easy task to evaluate the strength of this relationship. The majority of scientists are investigating the impact of certain Energy Sector's activities on the overall energy consumption, climate change or Economic growth. This article analyzes the influence of Energy Sector to GDP of Lithuania. The objective of the research is to show how the results of Lithuanian Energy Sector in 2005 – 2015 have been changed and to determine their impact on GDP. The concept of Energy Sector is presented first. Secondly, a methodology for analyzing the performance of the Economic growth and Energy Sector is described. Thirdly, the analysis of the activities of Energy Sector and its influence on GDP has been analyzed. The proposed model of the impact of the Energy Sector's activities on the growth of GDP in the article combines six main aspects of the research: participants in the Energy Sector; Energy balance indicators; Changes in energy product prices; The value added created by the Energy Sector; The main taxes paid by Energy Sector as part of the National budget revenue; The net profitability of the Energy Sector. This model is applicable for analyzing the aggregate performance indicators of Energy Sector and its impact on the growth of GDP. Hypothesis of this research - Lithuanian energy sector has a statistically significant influence on GDP. The findings showed that GDP and Energy Sector indicators, after a year of crisis, tended to grow. But the impact of these indicators on GDP is weak. However, particularly high correlation ratios between them may indirectly affect the change in GDP.

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### INTRODUCTION

Generally, economic growth is associated with an increase in Gross Domestic Product, namely growth of production volumes, as well as with companies' and individuals' increase of real income (Vainienė, 2005). Vosylius et al. (2013) in its research on economic growth, sustainable development and energy security identified Energy Sector as a contribution to the human, economic and social development cycle, which is essential for the sustainable development of developing coun-

tries. They also concluded that energy consumption in less developed countries encourages economic growth and sustainable development. And that we should try to compare rational and acceptable energy consumption taking into account the level of development of countries. Economic growth and export competitiveness can not be achieved by increasing intensity of energy total consumption, especially in the exporting industries.

Cantore et al. (2016) while analyzing policy of environmental conservation, assumes that efficiency of energy consumption is not only related to discussions on climate change, but also has a significant impact on economic development policy. International negotiations on climate change agreements are currently being stopped largely because developing countries are reluctant to join binding emission limits, fearing that this could hinder their economic growth. However, in their research, they deny that environmental policy can be completely incompatible with the economic growth strategy for small and middle-income countries. Energy efficiency policies can be acceptable solution from both environmental and economic perspectives. And the next step in implementing this policy is to realize that it is profitable for companies and stimulates economic growth.

Schandl et al. (2016) suggests that Energy Sector investments have to be made to infrastructure, production systems and technologies that enable products and services to be delivered at significantly lower costs, which is economically viable. Sghari and Hammam (2016) Tunisia's GDP growth relates with the rise in energy products, especially increase in electricity demand, which is directly dependent on the influence of other sectors of the economy.

A complex study of the impact of Energy Sector on the growth of Gross Domestic Product is quite rare since most scientists usually specialize in only one area of the Energy Sector. Thus, some researchers investigate energy efficiency as a matter of controlling climate change (Streimikiene et al., 2012; Cai, Zhan, 2014; Hamilton et al., 2013), Energy Consumption Impact on Health (Howden-Chapman, 2015; Willand et al., 2015; Maidment et al., 2014). Other specialists are studying the problems of reducing greenhouse gas emissions (Baležentis, 2011; Roos et al., 2012; Li et al., 2016), analyzing recursive sources of energy (Shafiei, Salim, 2013; Yang et al., 2016; Ki et al., 2013; Komonkiat and Cheirsilp, 2013; Burhan et al., 2015; Corgnale et al., 2013), as well as interaction between renewable energy policies and the renewable energy industry (Zhang et al., 2013; Mosannenzadeh et al., 2017; Gatzert and Vogl, 2016; Reddy et al., 2015) and explores the role of renewable energy in the economy (Klinge Jacobsen and Schröder, 2012; Silva et al., 2013; Bélaïd and Youssef, 2017). The largest part of the researches usually are aimed to determine the impact of certain activities in Energy Sector on total energy consumption, climate change or the economy. In this article it has been proposed to analyze the full set of Energy Sector performance's indicators and their impact on economic growth. The object of this article is the influence of Lithuanian Energy Sector on the growth of Gross Domestic Product. The objective of this research is to determine the dependence of the change in Gross Domestic Product on the performance of Energy Sector by examining changes in the activities of the Lithuanian gross domestic product and Energy Sector during 2005 - 2015. The tasks of the article are:

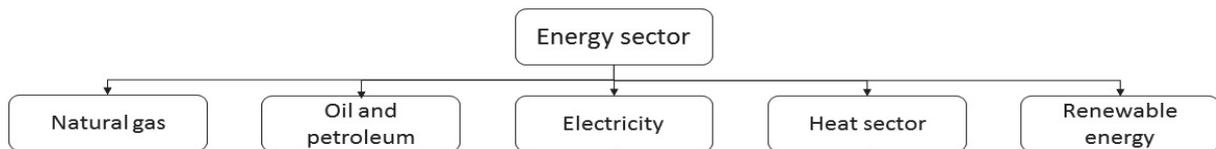
- to present the concept of the Energy Sector;
- to describe the methodology of the economic growth and analysis of Energy Sector performance; and
- to analyze the activity of Energy Sector and its impact on Gross Domestic Product.

The analysis of scientific literature used for theoretical and methodological part. The reports of the Department of Statistics of Republic of Lithuania are used for the development of the analytical part. Descriptive, graphical data visualization and statistical methods are used to analyze and present the results of the research.

## 1. THE CONCEPT OF LITHUANIAN ENERGY SECTOR

The objective of energetics according to Miškinis et al. (2016), is to ensure variety of channels of traditional fossils fuel and renewable resources supply and their stability as well as transformation or energetic resources. The allocation of Energy Sector is provided below (see 1 Fig.):

**Figure 1.** The allocation of Energy Sector



Source: Authors' estimation.

Lithuanian Energy Sector is allocated to five streams:

**Natural gas.** According to Esen, Oral (2014), natural gas, the importance of which is increasing in the energy market, is one of the three main types of fossil fuels in the world, along with coal and oil. However, according to Carvalho et al. (2014) he argues that the current European gas supply network is heavily dependent on supply from Russia and North Africa, which results in the vulnerability of social and political instability. Lithuanian natural gas system interconnected with Belorussian, Latvian and Russian counterparties. Starting from 3rd. December, 2014, LNG terminal began its operation in Klaipeda, therefore allowing to diversify supply of natural gas and enabling Lithuania to import natural gas different suppliers. Meanwhile on 2nd October, 2015 has been started exploitation of Klaipėda-Kuršėnai pipeline second thread. This pipeline allows to use full capacity of LNG terminal.

According to the Galinis (2015), the LNG terminal has reduced its dependence on the only gas supplier, while reinforced trunk networks and a new gas pipeline linking Lithuania and Poland and strengthening the link between Lithuania and Latvia will create preconditions for the establishment of a regional gas market. According to Misik, Pracharova (2016), the fall of Russia's energy products' supply capacity to Lithuania in 2014 will in the near future significantly change the situation of Energy Sector in the whole of the Baltic region. The general principles of organization of the natural gas sector in Lithuania and the activities of natural gas undertakings and relations with consumers (supplying, distributing, transferring and storing natural gas) are regulated by the Law on Natural Gas of Republic of Lithuania (2000), other legislative acts (regulations, descriptions, requirements, principles, etc.) regulate the activities of the natural gas industry. Natural gas distribution activities in Lithuania are carried out by 6 gas companies, for which the National Control Commission for Prices and Energy has issued distribution licenses.

**Oil.** According to Aydin (2012), oil is a limited natural resource, and stocks of these resources are rapidly depleted. Some have already reached their peak. Lithuania, according to Gaigalis, Skema (2016), given its geographical location and the distribution of fossil energy resources, has insufficient or limited amount of local energy resources and depends on the import of natural gas, crude oil and coal. The regulation of this sector in Lithuania has resulted in a large number of legislation regulating government stocks of petroleum products, restrictions on the use of petroleum products and trade, oil product equipment, quality and environmental protection, as well as oil products taxes. For more than two decades, this sector has been operating under market conditions, i.e. there are no legal restrictions for the import/export between EU and third; oil prices are not regulated by the state (except for liquefied petroleum gas supplied to group facilities), the state

only imposes excise duties and value added tax on petroleum products; it is imposed mandatory quality indicators for consumed petroleum products; there is also no quota for import or export.

**Electricity.** In the medium term, it is best for improving the country's economic situation to develop its own electricity generation sector, thus diversifying its export position and protecting its trading interests (Srinivasan, 2013). The basis for regulating the generation, transmission, distribution and supply of electricity in Republic of Lithuania is Law on Electricity of Republic of Lithuania (2002) which has been adopted in accordance with the requirements of European Union law, and which regulates the relationship between electricity service providers and consumers and the conditions for the development of competition in the electricity sector. Other activities - electricity supply and trade, public interests, connection and operation of electrical equipment, issuance of permits and licenses, redemption of energy objects, payments for electricity are determined by other normative acts, rules and descriptions, as well as European Union legislation, Directives and Regulations. The Lithuanian energy system consists of: power plants producing electricity (Lietuvos energija, AB), high voltage electricity transmission lines and equipment (LITGRID, AB) and low and medium voltage distribution network, which supplies electricity to the end user.

One of the strongest country's energy sides according to Galinis (2015) is well-developed electricity transmission and distribution networks that meet the needs of the energy system. In addition, the Lithuanian electricity system has strong links with neighboring countries, and new connections to the Polish and Swedish electricity systems will increase the reliability of electricity supply and create good preconditions for integration into the electricity markets of the Nordic and Western European countries.

**Heat sector.** Heat is an area of energy economy that is directly related to the production, transmission, supply and consumption of heat and hot water (Law on Heat and Power of Republic of Lithuania, 2013). Central heating supply in Lithuania is the main one, the basic principles of which are determined by the Law of energy of Republic of Lithuania, regulating the general principles of energy activities. And the Government control over central heating, activities of heating business entities, their relations with consumers, interconnections and responsibilities are regulated by the Law of Republic of Lithuania on Heating Sector (2003). Supervision of heat supply and heating equipment is determined by other normative acts, rules and descriptions. According to Galinis (2015), well-developed central heating systems operate in all Lithuanian cities, where the rational use of local and renewable energy resources can significantly reduce dependence on imports of primary energy resources. However, in the central heating sector, irrational trends in the development of water heating boilers and not thermal power plants predominate. And more than 70 percent of apartment buildings and a large number of public buildings are energetically inefficient, and their slow modernization can have serious economic and social consequences.

Heat energy can be produced at lower cost by burning biomass (Stolarsk, 2013).

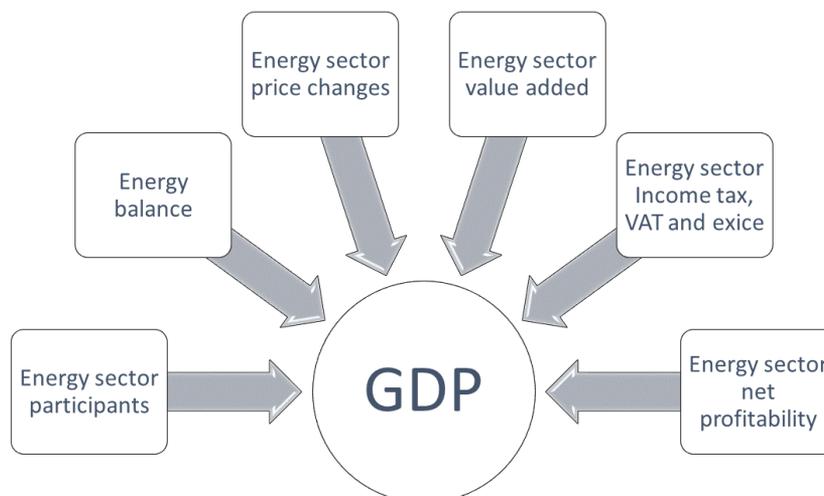
**Renewable energy (RES).** According to Streimikiene et al. (2005) renewable energy sources (including biomass, solar, wind, geothermal and hydropower) that use local resources can provide energy services with zero or near zero emissions and greenhouse gas emissions. The development of these resources is an important tool for energy policy to reduce dependence on imported fuels. This activity being regulated by Republic of Lithuania Law on Renewable Energy (2011), the Law on Energy of Republic of Lithuania (2000), and other normative and substatutory legal acts. Sustainable RES development is an important tool for reducing dependence on imported fuels. In recent years, the strategic goals set in the field of RES have allowed rapid development of local energy production capacities and renewable energy sources in Lithuania (Marčiukaitis et al., 2016). Lithuanian power plants are uncompetitive in the electricity market (Galinis, 2015)

All data on the extraction, supply, storage, consumption, export and import of energy products are collected and systematized, as well as the annual energy balances of Republic of Lithuania Department of Statistics. Energy balances are prepared according to the methodological recommendations of the international organizations preparing the consolidated balance sheets.

## 2. METHODOLOGY OF THE ASSESSMENT OF ENERGY SECTOR INFLUENCE ON GROWTH OF GROSS DOMESTIC PRODUCT

Energy Sector activity is the exploration, extraction, processing, production, storage, transportation, marketing and distribution of energy materials and products (oil, natural gas, coal, local fuels, renewable energy sources). Figure 2 illustrates the model of the methodology for assessing the impact of Energy Sector activities on economic growth.

**Figure 2.** Model for assessing the impact of Energy Sector on economic growth



Source: Authors' estimation.

This model depicts six key aspects of the study in assessing the impact of the Energy Sector's performance on Gross Domestic Product.

**Analysis of economic growth.** Economic growth (output growth) as discussed earlier in this article is measured by the increase in Gross Domestic Product. Gross Domestic Product is defined as the ultimate value of goods and services created over a given period in the country (Statistical Yearbook of Lithuania, 2013). According to Norkus (2015), GDP shows economic productivity and its ability to create new assets over a period of time. Stundžienė, Bliekienė (2012), as a result of the impact of economic fluctuations on the survey of Lithuanian enterprises, have found that the performance of enterprises is changing in the light of the economic situation in the country and that there is a particularly close connection between GDP growth and corporate income and profit growth. In order to understand what economic changes Lithuania has had over the past 10 years, the author of the article, using the reports of the Department of Statistics of Republic of Lithuania, made graphical and trend analysis of Gross Domestic Product. In order to determine the changes in the Lithuanian economic growth, the reports based on graphical and trend analysis of the Department of Statistics of Republic of Lithuania for the period of 10 years were used.

**Change of the participants in the Lithuanian Energy Sector.** In assessing and determining the impact of any economic sector on economic growth, it is worth analyzing the change and trend of participants in this sector. Lithuanian scientists did not carry out research of the impact of Energy Sector participants' change on Gross Domestic Product.

**The indicators of energy balance.** According to Miškinis, Galinis et al. (2016), the annual energy balances in international statistics are legitimized as the main way to describe the state of Energy Sector in a comprehensive way. Therefore, when building development strategies, planning

investments, the expediency of introducing new technologies it is proposed to analyze such indicators as: production of energy resources, exports, imports, energy product costs change and energy consumption. All energy resources and consumption are calculated in terms of contractual units - thousands of tons of oil equivalent (tne). (Methodology for the Statistical Yearbook of Fuel and Energy, 2010).

According to Ignotas, Stasytyte (2016), energy efficiency is one of the main energy balance indicators - energy consumption is one of the strategic directions of the European Union, with its special attention, high financial resources and ambitious goals. Kasperowicz (2014), studying the impact of Polish electricity consumption on economic growth, found that the total consumption of Polish energy products really has a causal impact on the country's economic growth. However, Bah, Azam (2017), in analyzing the impact of energy consumption on South African economic growth, observed that most studies relating to the economic status of different countries do not analyze the impact of Energy Sector on Gross Domestic Product. Using Pearson's correlation method, these authors have identified the link between end-use energy consumption and GDP in their countries. Vosylius, Rakutis, Tvaronavičienė (2013) concluded that the overall increase in energy consumption coincides with GDP growth. Soares et al. (2014), empirical results show a statistically significant relationship between GDP and energy consumption in Indonesia.

Other indicators (energy production, exports, imports, costs and energy dependence) are not influenced by economic growth surveys. But Dudzevičiūtė et al. (2017) study provided that twenty-two countries have a significant dependence between exports and economic growth. According to the order of the Director General of the Department of Statistics under the Government of Republic of Lithuania "On the Approval of the Methodology for the Formation of Fuel and Energy Balance" (2004), the indicators described in this article are described as follows:

*Fuel (energy) production* is fuel and energy produced from natural sources (primary) or fuel transformation (secondary). Primary fuel: oil, peat, firewood, wood and agricultural waste, biogas, nuclear power, hydropower, geothermal and wind energy. Secondary fuel: petroleum products, peat briquettes, biofuels, electricity and thermal energy.

*Import and Export* - Fuel and energy that crosses the state border (imported or exported) by land, air, water, electricity, oil or gas pipelines. It does not cover the transit of fuel and the fuel provided by the vehicle (car, aircraft, ship, etc.) abroad.

*Gross internal expenditure* - primary energy production plus regenerated products, plus imports, minus exports, minus sea bunkers, plus / minus stock changes. They represent the country's supply of fuel and energy or the total fuel and energy consumption in the country.

*Energy consumption* - fuel and energy delivered to end-users: industry, construction, agriculture, other businesses and households.

**Changes in Energy Sector prices.** According to the methodology developed by the Department of Statistics of Republic of Lithuania for the production of indexed industrial output (2014), the calculation of the producer price index is necessary for the analysis of various indicators at constant prices, for the analysis of the economic development, and for assessing changes in prices of Lithuanian manufactured products sold by industrial producers. According to Diffigli (2014), global economic growth will continue to be threatened by oil price spikes. According to Nyamdash, Denny (2013), the change in electricity prices directly affects the energy balance indicators. In Lithuania, the analysis of the impact of the change in prices on Gross Domestic Product has not been carried out.

**Value added of Energy Sector.** The high value added of products and services and their competitiveness on the global market are the basis of the Lithuanian economy (Ignotas, Stasytytė, 2016). Energy consumption and value added in Energy Sector should also be part of this framework. According to Tamošiunienė, Survilaitė (2013) value added is a key aspect of the company's success assessment. The goal of companies generating value added is to have a steady increase

in value added. And the positive and steady flow of gross value added means the stable existence of each company. In addition, value added of European companies is being studied in order to find out the latest trends and trends in the economy, activities and technologies. Studies that would reveal the impact of the added value generated by the Lithuanian Energy Sector on Gross Domestic Product were not conducted.

**Energy Sector taxes.** The national budget of any country is formed from different sources of income, usually taxes and other income. Taxes on value added, according to the data of the Department of Statistics, in 2016 amounted to 43 percent, excises – 17 percent, income tax – 9 percent. *Value Added Tax (VAT)* is the consumption tax paid by the final consumer. It is an indirect tax payable at each stage of the distribution of a product or service or production process. It is collected to the budget depending on the added value created (Law on Value Added Tax of Republic of Lithuania, 2002). According to Giesecke, Tran (2012) value added tax (VAT) has become the most widespread global consumption tax in the world.

*Excise duties* - indirect tax on goods. This tax is appreciated by the states, because relatively small efforts can be made to collect high revenues into national budgets. However, the excise tax puts a very high tax burden on consumers and encourages them to choose products of lower quality (for example, to buy cheaper and worse-quality cigarettes, alcohol). Excise duties violate the principle of neutrality of taxation, because some of the goods selected are subject to a relatively higher direct and indirect (administrative) tax burden than others (Vainienė, 2005). Excise taxes are levied in Lithuania on: ethyl alcohol and alcoholic beverages; processed tobacco; energy products; electric power (Law on Excise Duty of Republic of Lithuania, 2001).

*Income tax (corporation tax)* is collected on the profit of legal entities. Income tax is calculated on the basis of the income of legal persons less costs, amortization, investments in production, research, charity (Law on Corporate Income Tax of Republic of Lithuania, 2001). According to the data of the Department of Statistics of Republic of Lithuania, Value Added taxes on value added accounted for 43 percent in 2016, 17 percent in excise duties, 9 percent in taxes on profits. According to the data of the Statistical Office of Republic of Latvia, taxes from value added in 2016 amounted to 45 percent, excise duties - 18 percent, and income tax - 8 percent. Estonia's Statistics Department announces that value added taxes make up 33.8 percent of all state revenue, profit tax is 5 percent, excise duty is 12.6 percent. A separate study of the impact of taxes paid by the Lithuanian Energy Sector on Gross Domestic Product has not been conducted.

**Net profitability of Energy Sector.** According to most researchers, the net profitability ratio represents the financial result of an enterprise's operations, and this indicator is one of the most important (if not the most important) to owners of the company. The net profitability, well describes the final profitability of the company's operations (Dzikevičius, Jonaitienė, 2015). Stundžienė, Bliedienė (2012), while determining the impact of economic fluctuations on the survey of Lithuanian enterprises, found that the results of the companies' activities change in the light of the economic situation in the country and that there is a particularly close connection between GDP growth and the growth of corporate income and profit indicators. According to the authors of this article, the analysis of the change in the net profitability of the Lithuanian Energy Sector has been carried out, which will help to establish a link between this indicator and the GDP.

**Determination of the dependence between Energy Sector performance and Gross Domestic Product.** Pearson correlation coefficient is a measurement method. The linear correlation between two variables is measured and it gives a value between -1 and +1 (Wang et al., 2015 cit. Pearson, 1895). The Pearson correlation coefficient determines the linear relationship between the energy balance indicators, changes in energy product prices, value added of energy products, taxes paid, net profitability of the sector, and Gross Domestic Product of Republic of Lithuania.

### 3. ANALYSIS OF LITHUANIAN ENERGY SECTOR'S INFLUENCE ON GROSS DOMESTIC PRODUCT GROWTH

#### 3.1 Analysis of Lithuanian Economic Growth

Figure 3 shows the dynamics of the Lithuanian Gross Domestic Product change over the period of 2005 – 2015.

**Figure 3.** Dynamics of Changes in Lithuania's GDP during 2005 - 2015, mln. EUR



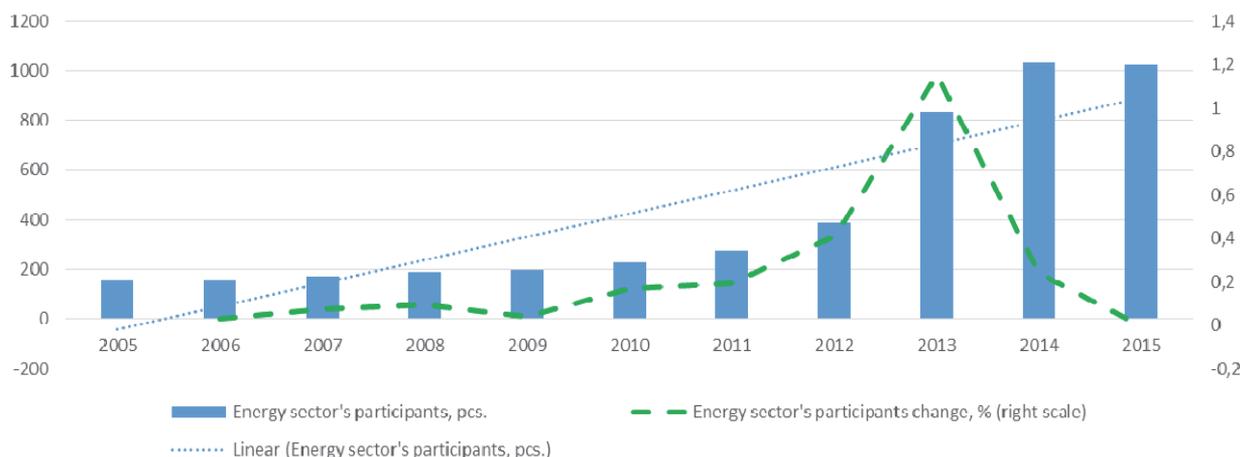
Source: Authors' estimation

From 2005 until the beginning of the crisis year 2008, Lithuania's Gross Domestic Product had a tendency to grow. The change in the number of absolute GDP is shown in Figure 2 (left-hand scale). Percentage GDP dynamics are represented by the right-hand scale of the graphic scale. In 2009, Lithuania's GDP fell by 18 percent since the crisis of 2008. Later, GDP began to grow. Already in 2012, the GDP indicator reached 2008 levels of GDP and continued to grow, about 2-5 percent each year. From 2005 to 2015 GDP in absolute terms increased by 16 328 million. EUR, which accounted for a

#### 3.2 Analysis of Participants in Lithuanian Energy Sector

Before assessing the performance of the Lithuanian Energy Sector, let's take a look at the change in participants in this sector in 2005 - 2015 (see 4 fig). During the period of 2005 - 2015, the number of Lithuanian Energy Sector participants remained almost unchanged. In 2009, as the Ignalina Nuclear Power Plant was shut down, which had of a lot of radioactive waste, Lithuania began to accelerate restructuring of Energy Sector by creating competitive conditions for energy companies. As a result, energy companies increased by 4 times during 2010-2015. Almost all of these companies are regulated in one way or another and are not subject to energy market trends. Trends in the activities of these market players are delayed as the impact is only after National Control Commission for Prices and Energy (NCCPE) sets new tariffs taking into account aforementioned market trends.

**Figure 4.** Change in the participants of the Lithuanian Energy Sector in 2005-2015, units

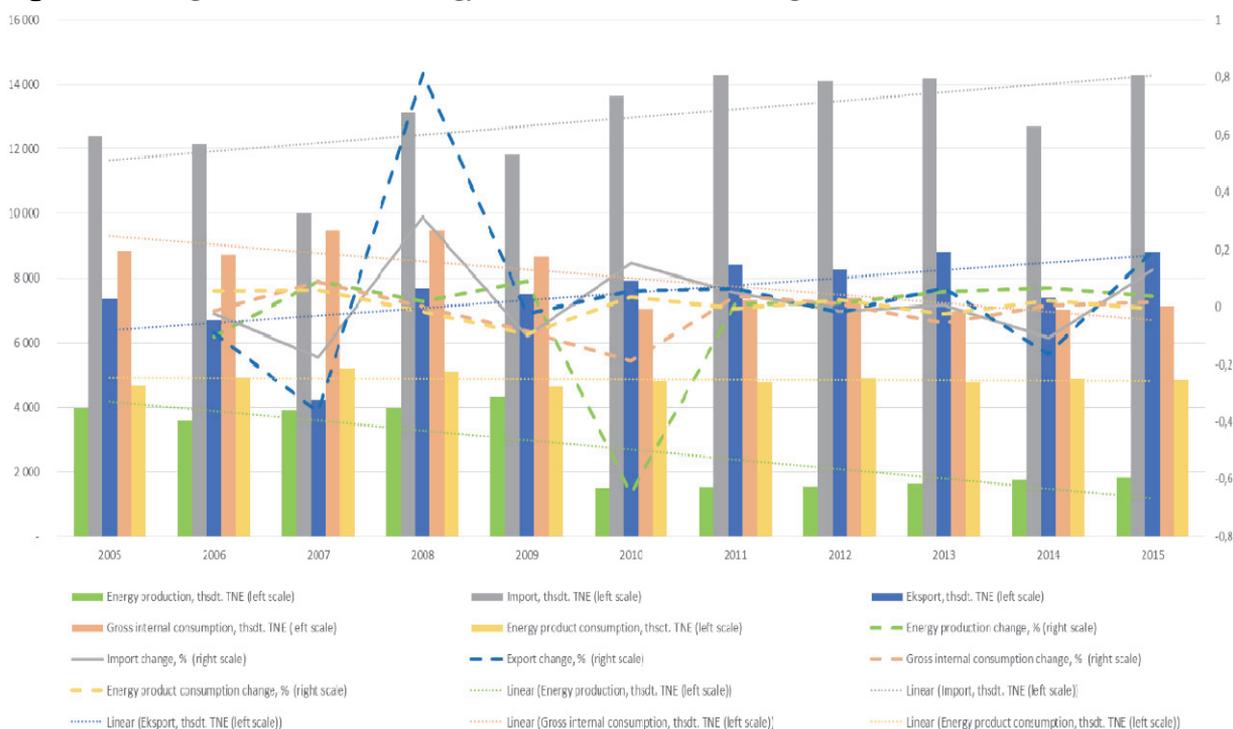


Source: Authors' estimation.

### 3.3 Analysis of Energy Balance Indicators of Lithuania

Figure 5 shows, according to the data of the Department of Statistics of Republic of Lithuania, consumption of energy products during the period 2005-2015.

**Figure 5.** Change in Lithuanian energy balance indicators during 2005 - 2015, thsd. TNE



Source: Authors' estimation.

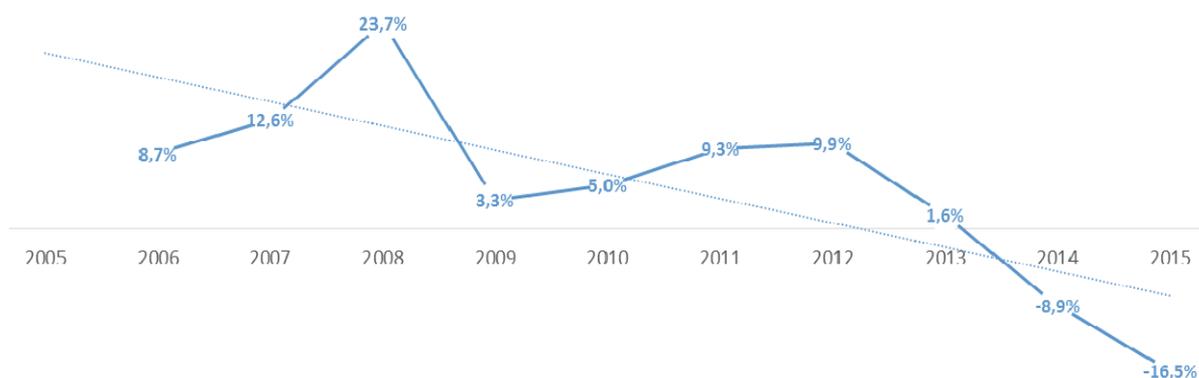
Energy production was a rather noticeable indicator of the energy balance by 2009, but as it was written earlier, energy production in 2010 dropped by 65 percent with the closure of the Ignalina Nuclear Power Plant. Growth of GDP in 2005 - 2015 saw a 7 percent increase in energy production. Figure 5 shows that, as well as GDP growth rates (see 3 Fig.), the growth rate of consumption of energy products declined significantly in the course of the year. However, unlike GDP growth in the post-crisis years, consumption of energy products does not have a significant growth trend. Based on data provided by the Department of Statistics of Republic of Lithuania, the graph of Figure 5 shows that the consumption of energy products did not reach the level of 2006-2008.

In 2008 noticed 32 percent increase in imports. In 2009, imports decreased by 10 percent. The general trend of change in the import indicator does not correspond to the dynamics of Gross Domestic Product. To sum up, it can be stated that since 2009 all energy balance indicators have tended to grow. Only not all of the changes were proportional to the change in GDP over the same period.

### 3.4 Analysis of Changes in Lithuanian Energy Sector Prices

As the price change of Energy Sector was chosen as an indicator for assessing the economic sector's dependence on the activities of the Energy Sector, let's take a look at the graphic in Fig. 6.

**Figure 6.** Dynamics of Changes in Lithuanian Energy Sector Prices in 2005 – 2015, percent



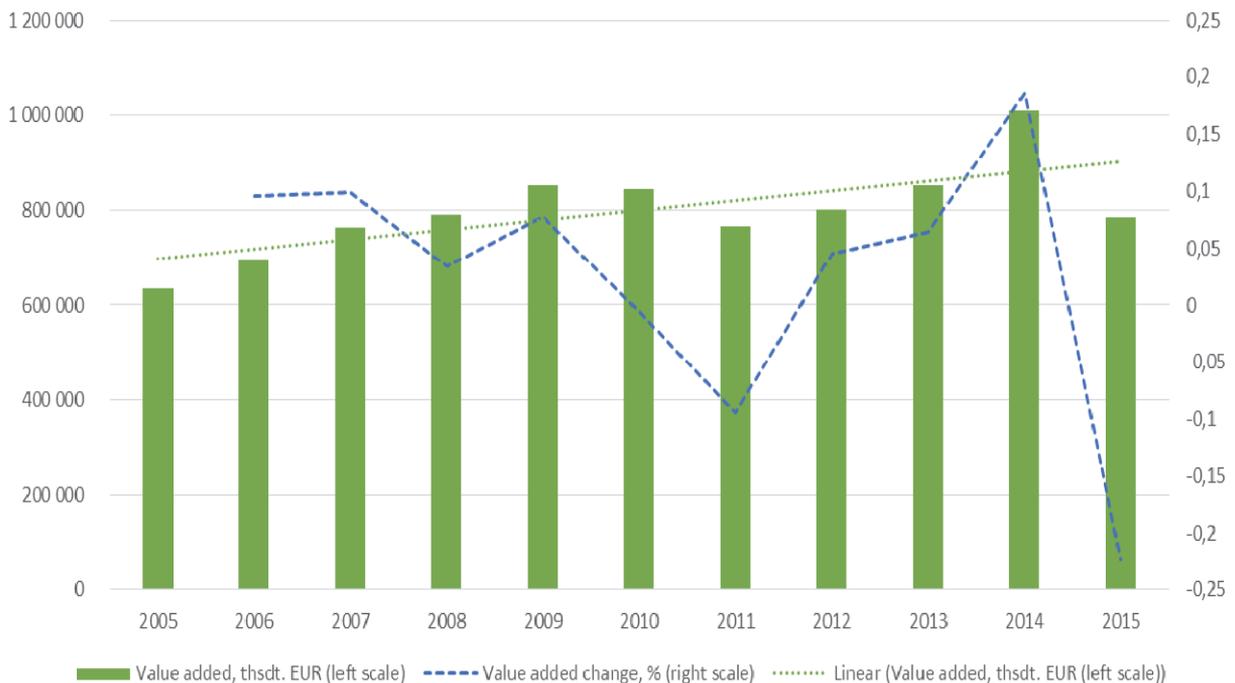
Source: Authors' estimation

It is very natural that in 2008, before the crisis, there was a sharp rise in energy prices, but also thereafter, by 2013, there was a rise in prices, due to the closure of the largest energy supplier - Ignalina Nuclear Power Plant. Whether the changes in energy prices affect economic growth should be answered by a linear correlation analysis

### 3.5 Analysis of Value Added of Lithuanian Energy Products

Department of Statistics of Republic of Lithuania provides data on value added of Energy Sector products. However, the results of value added for oil companies such as UAB Amic LT (formerly UAB Lukoil Baltija), UAB Circle K Lithuania (formerly Statoil Lietuva), UAB Baltic Petroleum, UAB Viada LT (formerly UAB " Luktrana "), UAB" Abromika ", UAB" Emsi ", etc, are not included in the total value added of the Energy Sector, but included in the results of retail trade, which is not possible to separate from this moment. Figure 7 shows the dynamics of the Energy Sector's value added, without oil.

**Figure 7.** Dynamics of value added of Lithuanian Energy Sector (without oil) in 2005-2015, thsd. €



Source: Authors' estimation

In 2009 the results of value added have increased with decrease of energy products consumption by the end user (see Chart 5). However, the comparison of the consumption of energy products and the dynamics of value added is not correct. Because the latter has no results from oil products, which amounts for 35 percent of energy consumption. Value added of energy products from 2005 to 2015 has a slight growth trend (see 7 Fig.). In 2015, compared to 2005, Energy Sector (without oil products) increased its value by 24 percent

### 3.6 Analysis of Excise, Value Added, Profit and Real Estate Taxes in the Lithuanian Energy Sector

According to the data of the Department of Statistics of Republic of Lithuania, a graph is presented in Figure 8, which shows the tax dynamics of all taxes paid to the Lithuanian national budget. Publicly available reports are for the period 2005-2015. Taking into account the data of the reports of the Department of Statistics of Republic of Lithuania, the graphical analysis of the tax revenue from the National Budget shows that the change in tax paid and the trend correspond to the country's GDP change. However, the main taxes paid by Energy Sector (excise duty, profit, value added, real estate) have a tendency to grow throughout the analyzed period. The main taxes paid by Energy Sector for a different year represented a fairly large share of the total revenues from the National Budget - from 14 to 19 percent. Excise taxes amounts for 27 percent of all national budget revenues. And the excise duty on energy products is about 59-60 percent of the total excise duty paid to the National Budget, of which even 98 percent comes from petroleum products, automobiles and other vehicles.

**Figure 8.** Dynamics of tax revenue from the budget of Lithuania in 2005 - 2015, thsd. EUR



Source: Authors' estimation.

Value added tax accounts for 43 percent of the total revenue from the National Budget. Value added tax in Energy Sector accounts for 5 percent of the total VAT paid on the national budget. But in these reports, as in the case of value added, there is no information about value added tax paid on the oil companies that are attributed to the retail sector. Since VAT is a final consumption tax, the dynamics of the change in Gross Domestic Product with value added tax changes from Energy Sector is not feasible for this moment because it eliminates 35 percent of the total consumption of energy products.

### 3.7 Profitability analysis of the Lithuanian Energy Sector

The dynamics of the sector's net profitability indicator was also reviewed (see 9 Fig.) in order to determine the relationship between the activity of Energy Sector and GDP. In this case, it is also difficult to fully assess the change in net profitability in the Energy Sector, as in the case of value added and value added analysis, the Lithuanian Department of Statistics does not provide the results of the profitability of oil companies with other companies in this sector.

However, Figure 9 shows a change in prices similar to those of the sector (see 6 Fig.). After the closure of the Ignalina Nuclear Power Plant in 2009, net profit dropped by as much as 89 percent. Later, with the increase in prices, the results of the analysis began to grow. The impact of the net profit of Energy Sector on Lithuania's GDP must be demonstrated by a linear correlation.

**Figure 9.** Net profitability of Lithuanian Energy Sector in 2005 - 2015, percent



Source: Authors' estimation.

### 3.8 Dependence analysis between Lithuanian Energy Sector activity results and Gross Domestic Product

While performing dependence analysis of variables and calculating the linear Pearson correlation coefficient the relation between Gross Domestic Product as a measure of the assessment of the country's economic situation and the market participants of the analyzed sector, energy balance indicators, changes in energy product prices, value added, basic (excise, profit, Value and immovable property) taxes and net profitability has been noticed. This dependence is given in Figure 10.

**Table 1.** Evaluation of dependence between Lithuanian Gross Domestic Product and Energy Sector performance

		Correlations										
		GDP	ESP	EP	IMPORT	EXPORT	GIC	EPC	PRICE	VA	TAX	PROFIT
GDP	Pearson Correlation	1	-.159	-.194	.360	.239	.022	.118	.245	-.402	.157	.103
	Sig. (2-tailed)		.642	.567	.278	.479	.950	.730	.468	.220	.644	.764
	N	11	11	11	11	11	11	11	11	11	11	11
ESP	Pearson Correlation	-.159	1	-.714*	.435	.415	-.683*	-.105	-.765**	.609*	.682*	.090
	Sig. (2-tailed)	.642		.014	.181	.205	.021	.758	.006	.047	.021	.793
	N	11	11	11	11	11	11	11	11	11	11	11
EP	Pearson Correlation	-.194	-.714*	1	-.765**	-.508	.909**	.162	.629*	-.374	-.450	-.015
	Sig. (2-tailed)	.567	.014		.006	.111	.000	.634	.038	.257	.165	.964
	N	11	11	11	11	11	11	11	11	11	11	11
IMPORT	Pearson Correlation	.360	.435	-.765**	1	.647*	-.751**	-.382	-.277	.150	.310	-.395
	Sig. (2-tailed)	.278	.181	.006		.031	.008	.247	.410	.659	.353	.229
	N	11	11	11	11	11	11	11	11	11	11	11
EXPORT	Pearson Correlation	.239	.415	-.508	.647*	1	-.533	-.385	-.286	.366	.230	.018
	Sig. (2-tailed)	.479	.205	.111	.031		.092	.243	.394	.268	.496	.957
	N	11	11	11	11	11	11	11	11	11	11	11
GIC	Pearson Correlation	.022	-.683*	.909**	-.751**	-.533	1	.443	.664*	-.518	-.228	.221
	Sig. (2-tailed)	.950	.021	.000	.008	.092		.173	.026	.103	.501	.514
	N	11	11	11	11	11	11	11	11	11	11	11

EPC	Pearson Correlation	.118	-.105	.162	-.382	-.385	.443	1	.467	-.004	.491	.465
	Sig. (2-tailed)	.730	.758	.634	.247	.243	.173		.148	.992	.125	.149
	N	11	11	11	11	11	11	11	11	11	11	11
PRICE	Pearson Correlation	.245	-.765**	.629*	-.277	-.286	.664*	.467	1	-.375	-.179	-.052
	Sig. (2-tailed)	.468	.006	.038	.410	.394	.026	.148		.255	.598	.879
	N	11	11	11	11	11	11	11	11	11	11	11
VA	Pearson Correlation	-.402	.609*	-.374	.150	.366	-.518	-.004	-.375	1	.477	-.191
	Sig. (2-tailed)	.220	.047	.257	.659	.268	.103	.992	.255		.138	.574
	N	11	11	11	11	11	11	11	11	11	11	11
TAX	Pearson Correlation	.157	.682*	-.450	.310	.230	-.228	.491	-.179	.477	1	.104
	Sig. (2-tailed)	.644	.021	.165	.353	.496	.501	.125	.598	.138		.760
	N	11	11	11	11	11	11	11	11	11	11	11
PROFIT	Pearson Correlation	.103	.090	-.015	-.395	.018	.221	.465	-.052	-.191	.104	1
	Sig. (2-tailed)	.764	.793	.964	.229	.957	.514	.149	.879	.574	.760	
	N	11	11	11	11	11	11	11	11	11	11	11
* . Correlation is significant at the 0.05 level (2-tailed).												
** . Correlation is significant at the 0.01 level (2-tailed).												

GDP – General domestic product; ESP - Energy Sector participants; EP - Energy production; IMPORT – Import; EXPORT – Eksport; GIC - Gross internal expenditure; EPC - Energy product consumption; PRICE - Energy Sector product price change; VA – Energy Sector value added; TAX- Income from Energy Sector tax; PROFIT - Energy Sector net profitability.

Source: Authors' estimation.

The results of the analysis of Gross Domestic Product and Energy Sector's performance have shown that:

- correlation of the Lithuanian Gross Domestic Product and Energy Sector's participants is weak (-0.159);
- also weak influences of the production's volume of Energy Sector on the change of Gross Domestic Product;
- the assertion of Dudzevičiūtės et al. (2017) approved - the country's economic growth depends on the export of products, since the export of Energy Sector weakly influences the change in GDP;
- the results of the dependence analysis showed that the gross internal expenditure of Energy Sector does not affect the growth of Lithuania's economy, as the result of correlation analysis is very low - 0.022;
- the correlation coefficient between Gross Domestic Product and total energy consumption is 0.118, which can not prove Kasperowicz (2014), Soares et al. (2014) and Bah, Azam (2017) statement, that there is a strong correlation between Gross Domestic Product and final energy consumption, and also the hypothesis of Vosylius, Rakutis and Tvaronaviciene (2013) can not be confirmed that economic growth and export competitiveness can be achieved without promoting increased energy consumption intensity, as the final consumption correlation of Lithuanian Gross Domestic Product and energy products is weak but positive, and that means that decrease in final energy consumption can negatively influence the change in Gross Domestic Product;
- Changes in the prices of energy products and the coefficient of dependency of Gross Domestic Product showed a weak direct relationship of 0.245;
- Value added created in the Lithuanian Energy Sector has a weak influence on the change in the Lithuanian Gross Domestic Product;

- the correlation between Gross Domestic Product and the tax rate paid by Energy Sector is low (0,157), which indicates a weak positive relationship between these variables;
- there was a weak link between GDP and the net profit margin of the Energy Sector, which did not exclude Stuzenžiene, Bliekiene (2012) assertion, that the results of the companies' performance change in the light of the economic situation in the country, but did not confirm their opinion that there is a particularly close link between GDP growth and growth of corporate income and profit indicators.

The results of this study's dependency analysis showed particularly high dependencies among the energy performance indicators chosen. Thus, there is a particularly close relationship between the number of participants in Energy Sector and the change in the prices of energy products (-0.765), the production and import of energy products (-0.765), energy production and domestic energy consumption (0.909), import of energy products and production of energy products (-0.765), and also the internal energy expenditure indicator (-0.751) may indirectly influence the change in Gross Domestic Product.

## CONCLUSIONS

A comprehensive study of the impact of the energy sector on the growth of gross domestic product is rare since most researchers specialize in one area of the energy sector. Scientists are investigating efficiency of energy consumption as an issue of as climate change regulatory policy, energy consumption effect on the health, the reduction of greenhouse gas emissions, the sources of renewable energy, or the relationship between renewable energy policies and renewable energy industry as well as the impact of the renewable energy on the economy. There is a lack of scientific research on the impact of the energy sector on the growth of the country's gross domestic product.

The country's energy sector can be divided into five areas of activity: natural gas, oil, electricity, heating, renewable energy sources. When analyzing the influence of the energy sector on the growth of Gross Domestic Product in particular country, it is necessary to evaluate changes of the separate energy sector's indicators during relevant period as well as to define their impact on the growth of Gross Domestic Product of that country.

Analysis of Lithuanian Energy Sector's indicators during 2005 – 2015 (such as change in the Energy Sector participants, energy balance indicators, changes in the Energy Sector prices, value added, taxes and net profitability of the energy sector) has produced findings that indicators of Gross Domestic Product, number of participants, energy products import and export, final consumption of energy products, values added generated by the energy sector, key taxes and net profit margins in the post-crisis years had tendency to grow. However, only the dynamics of gross domestic product and gross energy consumption variation coincide. Energy production's and general internal expenditure decreased over the analyzed period.

The study of the influence of the Energy Sector on the Growth of Lithuanian Gross Domestic Product showed that the ratio of correlation between total energy consumption and Gross Domestic Product is weak, thus denying the opinion of the South African, Austrian and Polish scientists that the results of the country's Gross Domestic Product largely depend on the total consumption of the energy product. The hypothesis of Lithuanian scientists has been also excluded - namely that Economic Growth and export competitiveness could be achieved without encouraging an increase in the intensity of final energy consumption, as correlation relationship between final consumption and Lithuanian Gross Domestic Product is weak, however it is still positive, which means that decrease in final energy consumption could negatively affect Gross Domestic Product's variation. Other Energy Sector's results also have a small impact on the growth of Lithuania's economy. However, the particularly high correlation coefficients between the number of energy sector participants and the change in the prices of energy products, the indicator of the production and import of energy products, the production of energy and internal energy expenditure, the import of energy

products and the generation of energy products, and also the indicator of internal energy expenditure, can indirectly influence the variation of Gross Domestic Product.

The investigation revealed that all oil companies according to the Resolution of the Government of the Republic of Lithuania "On Classification of Economic Activities" (1995) are attributed to the retail sector. This elimination does not allow us to gather enough information about the value added of the Energy Sector and the main taxes. As the performance of oil companies is eliminated, to authors opinion, this may reduce the level of dependency between the gross domestic product and the value added created and taxes paid. When analyzing the influence of the energy sector on the growth of the Lithuanian Gross Domestic Product, it is proposed to separate all the results of oil companies from the data of the retail sector and to analyze them jointly with other sectors of the energy sector. In addition, it is relevant to analyze the impact of energy sector's different activities on the growth of the country's gross domestic product.

## REFERENCES

- Aydın, L. (2012), „The economic impact of petroleum royalty reform on Turkey's upstream oil and gas industry“, *Energy Policy*, No. 43, pp. 166–172.
- Baha, M., M., Azam, M. (2017), „Investigating the relationship between electricity consumption and economic growth: Evidence from South Africa“, *Renewable and Sustainable Energy Reviews*, No. 80, pp. 531–537.
- Cantore, N., Cali, M., te Velde, W., D. (2016), „Does energy efficiency improve technological change and economic growth in developing countries?“, *Energy Policy*, No. 92, pp. 279–285.
- Carvalho R, Buzna L, Bono F, Masera M, Arrowsmith DK, et al. (2014), „Resilience of Natural Gas Networks during Conflicts, Crises and Disruptions“, *PLoS ONE*, No. 9(3), e90265. doi:10.1371/journal.pone.0090265
- Difigliom C. (2014), „Oil, economic growth and strategic petroleum stocks“, *Energy Strategy Reviews*, No. 5, pp. 48 – 58.
- Dudzevičiūtė, G., Šimelytė, A., Antanavičienė, J. (2017), „Causal Nexus Between Export and Economic Growth in the European Union Countries“, *Montenegrin Journal of Economics*, Vol. 13, No. 2, pp. 107-120.
- Dzikevičius, A., Jonaitienė, B. (2015), „Finansinių santykių rodiklių, geriausiai įvertinančių skirtinguose Lietuvos sektoriuose veikiančias įmones, paieška“, *Verslas: Teorija ir praktika*, No. 16(2), pp. 174–184.
- Esen, V., Oral, B. (2016), „Natural gas reserve/production ratio in Russia, Iran, Qatar and Turkmenistan: A political and economic perspective“, *Energy Policy*. No. 93, pp. 101– 109.
- Gaigalis, V., Skema, R. (2016), „A review on solid biofuel usage in Lithuania after the decommissioning of Ignalina NPP and compliance with the EU policy“, *Renewable and Sustainable Energy Reviews*, No. 54, pp. 974–988.
- Galinis, A. (2015), available at: [http://www.lei.lt/\\_img/\\_up/File/atvir/2016/NES/1-Lietuvos\\_energetikos\\_pletros\\_tyrimo\\_santrauka-2015.11.16.pdf](http://www.lei.lt/_img/_up/File/atvir/2016/NES/1-Lietuvos_energetikos_pletros_tyrimo_santrauka-2015.11.16.pdf) (accessed 12 July 2017).
- Giesecke, J., Tran, N., H. (2012), „A general framework for measuring VAT compliance rates“, *Applied Economics*, 44:15, 1867-1889, DOI:10.1080/00036846.2011.554382.
- Ignotas, A., Stasytė, V. (2016), „Efficiency of energy consumption as a base for sustainable Energy Sector“, *Verslas: Teorija ir praktika*, No. 17(2), pp. 128–137.
- Kasperowicz, R. (2014), „Electricity Consumption and Economic Growth: Evidence from Poland“, *Journal of International Studies*, Vol. 7, No. 1, pp. 46-57.
- Latvia Central statistical bureau database, available at: <http://www.csb.gov.lv/en/dati/statistics-database-30501.html> (accessed 12 July 2017).
- Lietuvos Respublikos akcizų įstatymas (2001), available at: <https://www.e-tar.lt/portal/lt/legalAct/TAR.B9E1D301256F> (accessed 12 July 2017).
- Lietuvos Respublikos atsinaujinančių išteklių energetikos įstatymas, (2011), available at: <https://>

- [www.e-tar.lt/portal/lt/legalAct/TAR.FC7AB69BE291](http://www.e-tar.lt/portal/lt/legalAct/TAR.FC7AB69BE291) (accessed 12 July 2017).
- Lietuvos Respublikos energetikos įstatymas (2002), available at: <https://www.e-tar.lt/portal/lt/legalAct/TAR.44235B485568> (accessed 12 July 2017).
- Lietuvos Respublikos gamtinių dujų įstatymas (2000), available at: <https://www.e-tar.lt/portal/lt/legalAct/TAR.0C5C33AA865C> (accessed 12 July 2017).
- Lietuvos Respublikos pelno mokesčio įstatymas (2001), available at: <https://www.e-tar.lt/portal/lt/legalAct/TAR.A5ACBDA529A9> (accessed 12 July 2017).
- Lietuvos Respublikos pridėtinis vertės įstatymas (2002), <https://www.e-tar.lt/portal/lt/legalAct/TAR.ED68997709F5> (accessed 12 July 2017).
- Lietuvos Respublikos šilumos ūkio įstatymas (2003), available at: <https://www.e-tar.lt/portal/lt/legalAct/TAR.F62AD965997D> (accessed 12 July 2017).
- Lietuvos statistikos metraštis (2013), available at: <https://osp.stat.gov.lt/services-portlet/pub-edition-file?id=15289> (accessed 12 July 2017).
- Marčiukaitis, M. et al. (2016), „Atsinaujinančių energijos išteklių naudojimo Lietuvoje patirtis, reikšmė ir siekiai“, *Energetika*, Vol. 62, No. 4, pp. 247–267.
- Metinio kuro ir energijos statistinio tyrimo metodika (2010), available at: [https://osp.stat.gov.lt/documents/10180/129995/metodika\\_kuras\\_energija\\_metine.pdf](https://osp.stat.gov.lt/documents/10180/129995/metodika_kuras_energija_metine.pdf) (accessed 12 July 2017).
- Mišík, M., Prachárová, V. (2016), „Before ‘Independence’ Arrived: Interdependence in Energy Relations between Lithuania and Russia“, *Geopolitics*, Vol. 21, No. 3, pp. 579–604.
- Miškinis, V., Galinis, A., Konstantinavičiūtė, I., Lekavičius, V., Tarvydas, D. (2016), „Matematinis modeliavimas – energetikos strateginio planavimo pagrindas“, *Energetika*, Vol. 62, No. 4, pp. 219–231.
- Nyamdash, B., Denny, E. (2013), „The impact of electricity storage on whole sale electricity prices“, *Energy Policy*, No. 58, pp. 6–16.
- Norkus, Z. (2015), „Kas turtėjo greičiausiai? Baltijos šalių ūkio augimo 1913–1938 metais palyginimas“, *Politologija*, No. 3 (79), pp. 3-54.
- Schandl, H. et al. (2016), „Decoupling global environmental pressure and economic growth: scenarios for energy use, materials use and carbon emissions“, *Journal of Cleaner Production*, No. 132, pp. 45–56.
- Sghari, M., B., A., Hammami, S. (2016), „Energy, pollution, and economic development in Tunisia“, *Energy Reports*, No. 2, pp. 35–39.
- Soares, J., A., Kim, Y., K., Heo, E. (2014), „Analysis of causality between energy consumption and economic growth in Indonesia“, *Geosystem Engineering*, Vol. 17, No. 1, pp. 58–62.
- Srinivasan, S. (2013), „Electricity a satraded good“, *Energy Policy*, No. 62, pp. 1048–1052.
- Statistics Estonia, available at: <http://www.stat.ee/economy> (accessed 12 July 2017).
- Statistics Lithuania, available at: <https://osp.stat.gov.lt/statistiniu-rodikliu-analize#/> (accessed 12 July 2017).
- Stolarski, M., J., Szczukowski, S., Tworkowski, J., Krzyzaniak, M. (2013), „Cost of heat energy generation from willow biomass“, *Renewable Energy*, No. 59, pp. 100-104.
- Streimikiene, D., Burneikis, J., Punys, P. (2005), „Review of renewable energy use in Lithuania“, *Renewable and Sustainable Energy Reviews*, No. 9, pp. 29–49.
- Stundžienė, A., Bliėkienė, R. (2012), „Ekonomikos svyravimų įtaka įmonių veiklos rezultatams“, *Verslas: Teorija ir praktika / Business: Theory and Practice*, No. 13(1), pp. 5–17.
- Tamosiuniene, R., Survilaite, S. (2013), „Intangible aspect of value added“, *European scientific journal*, Vol. 1, pp. 285-290.
- Vainienė, R. (2005), *Ekonomikos terminų žodynas: apie 1400 terminų*, Tyto alba, Vilnius.
- Vosylius, E., Rakutis, V., Tvaronavičienė, M. (2013), „Economic growth, sustainable development and energy security interrelations“, *Journal of Security and Sustainability Issues*, Vol. 2(3), pp. 5–14.
- Wang, S. et al. (2015), „Economic level and human longevity: Spatial and temporal variations and correlation analysis of per capita GDP and longevity indicators in China“, *Archives of Gerontology and Geriatrics*, No. 61, pp. 93–102.