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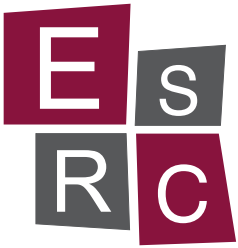

Energy Security Research Centre

LITHUANIAN ENERGY SECURITY

ANNUAL REVIEW 2013–2014

VYTAUTAS MAGNUS UNIVERSITY

VERSUS AUREUS

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ENERGY SECURITY RESEARCH CENTRE

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INTRODUCTORY STATEMENT BY THE HEAD OF ENERGY SECURITY RESEARCH CENTRE

The last year was very important, full of various events and processes, which affected different areas of life including Lithuanian energy sector. Russian military aggression against the Ukraine and decline in oil prices were particularly important and exceptional events for Lithuania. Only these events were enough to trigger a number of discussions on the issues regarding the Lithuanian energy security. Was it really necessary to build the liquefied natural gas terminal as the natural gas price is declining and such a terminal may no longer be necessary? Should we continue developing the renewable energy sources in Lithuania as the oil prices are returning to the levels seen some decades ago, and we will be able to heat our houses at an easy rate, and is it rational to continue their renovation? Maybe we should start changing our energy strategy and review all the existing projects? These issues have been of particular importance to Lithuanian energy security, as they require complex responses, wisdom and farsightedness.

This period was unique not only with regard to the abundance of global events, but also because of the important achievements in Lithuanian energy sector. A long waited liquefied natural gas terminal was finally moored to her jetty in Klaipėda. Despite the failure to transform this project into the EU supported regional energy security project, it is one of the first objects which provides a possibility for Lithuania as well as for other Baltic countries to no longer depend on the single natural gas supplier, thus discontinue unlimited domineering position of the supplier to increase the prices of this kind of fuel. Although at present, the terminal is performing at its minimum capacity, but the price of natural gas supplied by Gazprom to Lithuania had been reduced by one fifth prior to the outset of the terminal exploitation. With further decrease in oil and gas price, broader opportunities open for the terminal to operate not only in the gas market of the Baltic states, but also to work in Polish or even Ukrainian gas supply systems. Even the supply of electricity in Lithuania, which is currently based on the import from Scandinavian

countries and from Russia, has become more secure as, owing to the terminal and in case of necessity, Lithuania has capacities to produce the necessary amount of electricity.

Furthermore, the renewable energy sources play an increasingly important role in Lithuanian energy sector. For a considerable period of time, wind power plants have become an inseparable part of Lithuanian landscape and wind energy have reached the set limit – five hundred megawatt capacity – quite easily. The last year was also very intensive for bio-fuel power generation constructors. The largest Lithuanian cities, Kaunas in particular, increased the production of heat from bio-fuel, and this led to the decrease of heat prices for consumers. This process was so rapid that now it is necessary to correct plans with regard to location of larger-scale co-generational capacities in the system of heat production. Unfortunately, uncontrolled penetration of renewable energy into the energy system raises a number of additional issues. It is necessary to consider what capacities will balance the irregularity of these resources; there is a threat of domineering of single energy production technology, etc.

It is worth reminding the reader that the idea proposed for the energy security assessment is connecting into one common characteristic various elements, such as reliability of energy supply, energy prices and energy system resistance to various disturbances, which can be caused not only by technical emergencies or natural disasters but also by social, political or geopolitical factors. Thus, the guarantee of energy security is the search for appropriate solutions in the area of compromises without making any of decisive factors absolute. For the third successive time, indicators of Lithuanian energy security are presented in this publication, comparing them with the previous year's indicators and assessing the impact exerted upon them by major energy infrastructure projects.

I hope that this overview will help the readers to perceive the importance of energy security, understand its multi-faceted nature and will allow forming their attitude about the future of Lithuanian energy sector.

Prof. Juozas Augutis

1. THE CONCEPT OF THREATS TO LITHUANIAN ENERGY SECURITY

1.1. The concept of energy security threats

Every energy system is surrounded by a variety of threats. A threat could be defined as any potential danger that exists within or outside the energy system and that has a potential to result into some kind of obstruction of that system. Hence, manifestation of energy security threats can reduce the overall energy security level.

The sources of threat can be of sociopolitical, natural or technogenic character. Threats can be provoked by specific subjects (the state, energy companies, terrorist organisations, individuals), who can change the conditions in the energy sector and cause damage by their actions, decisions or inactivity.

Energy security threats can be deliberate and unintended. Deliberate threats occur when specific individuals attempt to cause damage; therefore, all of them are of social character. Unintended threats arise as a result of unintentional acts, unexpected events or processes. The conditions of energy security determined for Lithuania are similar to energy security conditions for other energy consumers:

- An opportunity to ensure energy supply for consumers in the required amount;
- An acceptable energy price with regard to market conditions and economic potential of the state, economy subjects and inhabitants;
- Conditions for energy supply that do not violate national interests;
- Streamlined functioning of enterprises and equipment intended for extraction, production, transformation, transmission, distribution and consumption of various energy resources, as well as ability to resist disturbances caused by threats.

In order to protect themselves from energy security threats, states create barriers that reduce the possibilities of threat manifestation, diminish their consequences or shorten their duration.

Barriers are grouped into:

- Technological barriers: reliability of infrastructure, varietal and geographic diversification of resources, energy effectiveness;
- Social barriers: political, social, based on external relations;
- Economic barriers: financial stability and capacity, the level of economic development, the character of prevailing industry.

Every state has different barriers of different power. However, the absence of energy supply alternatives is considered to be a major energy security threat, as it can result in interruption of energy supply. The lack of such alternatives has an effect on political and economic security sectors, because decision makers or economy subjects must take the interests of a single energy supplier into their consideration.

1.2. Threats to Lithuanian energy security

Energy security threats depend on the existing national and international factors, change in time and space, so the complete threat list is unique for each state at a certain period of time. The following list covers medium and long-term threats to Lithuanian energy security, the effect of which is significant for the Lithuanian energy sector.

1.2.1. Technogenic threats

Technical accidents in the energy production, resource transportation and energy transmission infrastructure. Energy security threats can manifest in accidents of pipelines, product supply systems, oil terminals, gas mains and electricity networks. Their effect on energy security as well as on other security sectors would be very different.

Technical accidents in energy production (heat and electricity) and processing enterprises. The consequences of such accidents are

direct and indirect. For example, after a major accident in "Orlen Lietuva" – the oil refinery plant, all petroleum products would have to be imported and budget income would be significantly lower. However, that would not cause a shortage of gasoline or diesel fuel, as their supply is possible from various other sources. The likelihood of such accidents is fairly small.

1.2.2. Sociopolitical threats

Corruption. The level of corruption inside the country, as well as in the supplier and transit states is significant for energy security, as the disturbances in resource supply and growth of prices could be caused by corruption. It manifests itself as a latent[1] type of threat. The level of corruption in Lithuania is decreasing, but it remains high in Russia – the main energy resource exporter and Belarus – the main transit state.

High tariffs for resource extraction and consumption. The threat occurs when energy resource extraction or production is limited by various taxes and it becomes economically unattractive; consumer tariffs inhibit the development of economics and become unacceptable to consumers. Excises for fuel adopted in the EU are practically the highest in the world. The excise for diesel in Lithuania is one of the lowest ones in the European Union, so as the average purchasing power of Lithuanians.

Environmental standards and regulations. On the one hand, environmental standards and regulations have a positive effect on the environment, on the other hand, the threat of environmental requirements manifests itself when the regulatory mechanisms limit extraction and consumption of certain kinds of resources, thus reducing the number of opportunities to increase the potential of local extraction and diversify energy resources geographically, as well as according to their types. The growing price for CO_2 emission

[1] Existing but not yet developed or manifest; hidden or concealed.

permissions can limit the use of certain kinds of fossil fuel for the production of energy. Still, in this respect Lithuania is not seriously endangered as the energy production structure is based on the consumption of natural gas, the CO_2 emission of which is more than twice less than the emission in the case of coal.

Low government effectiveness. This threat has a constant effect, which may have rather negative consequences for energy security. At the national level, it may cause interruption in energy supply and increase energy prices if activities are connected with individual political interests; it also influences the manifestation of political interests through termination of energy supply or imposing sanctions. Lithuania has a relatively high index of government effectiveness; however, it is considerably lover in Russia – the main energy supplier and Belarus – the main transit state.

High energy market concentration or formation of monopolies. Dependence on a small number of energy suppliers, absence of infrastructure alternatives and poor resource variety pose threats to the stable energy supply at reasonable prices. Concentration of energy resources, transportation and processing facilities in monopolistic enterprises or government structures offer opportunities for monopolists to abuse their position, create cartels, increase requirements for consumers or threaten limitations of energy supply. Lithuania faces internal and external market concentration threats.

Terrorist attacks. Considering the situation of the state in the international system and the conditions inside the state, the likelihood of terrorist attacks in Lithuania is low, but they may manifest through attacks against energy infrastructure situated outside Lithuania's boarders. Attacks are also possible in cyber space.

Society resistance to strategic energy projects. These threats receive rather controversial assessment. On the one hand, the public opinion presenting a negative approach to new energy projects is expressed by the results of voting, referendums or polls. On the other

hand, objective calculations prove that a number of projects rejected by the society would be useful in the long-run perspective and would increase the overall energy security level. The causes for such situations are different – poor publicity, the influence of the interested social groups or individuals, emergence of monopolies, high financial investments at the beginning of the project and the like.

Aggressive policy of supplier states against the consumer states. Aggressive policy of the supplier state can be demonstrated through interruptions in energy supply, limitations or increasing prices. In Lithuania, this threat manifested itself in oil and gas systems. Though this threat is difficult to forecast, research shows that the opportunity for such threat appears in the process of negotiation for long-term supply agreements.

Interruption of energy resource due to disorders in the transit chain. This kind of threat manifested itself in the Lithuanian gas system. The likelihood of the threat increases significantly when negotiating the transit prices.

International armed conflict. This threat has not manifested in Lithuania, but it has to be taken into consideration that during the armed conflict, energy infrastructure becomes one of the most important targets. Events of this kind may influence energy security of distant countries as well because of supply disturbances and increase in energy prices. Lithuania is unable to individually create barriers for manifestation of such threat. Having joined NATO, Lithuania has reduced the likelihood of invasion in the country, but it still remains sensitive to the changes in energy prices caused by military conflicts around the globe.

Political instability of the consumer, supplier and transit states. These threats are characterised by slow, but long-lasting effect. Political instability of important energy suppliers can increase resource prices and shut down the supply. Lithuania can be considered a stable state, but lower political stability of Russia and Belarus can pose a threat to Lithuanian energy security.

1.2.3. Natural threats

Extreme temperature. Temperature changes in Lithuania usually are not very significant and long-lasting, but they are often accompanied by side effects, such as frost and ice formation on the electric wires, movement of the ground because of the permafrost and the like. Due to notably low temperatures and poor quality of pipelines, most centralised heating consumers may experience disturbances in heat supply. Technical accidents may also happen, as well as the increase in the demand of natural gas. The demand for electricity, increasing because of exceptionally high temperatures may cause the overcharge, which in its turn acts as an incentive for abrupt price growth in the electricity exchange market.

Extreme wind, rainfall, droughts. These natural phenomena are rather typical for the Baltic region; some of them have become especially intensive in the past decades. It is almost every year that extreme winds and squalls cause interruptions in electricity supply. Lithuanian windmill park is growing, and the opposite phenomenon – absence of the wind is also causing negative influence on electricity prices.

Technogenic and natural threats can be prognosticated relying on statistics, meteorological models and observation of natural phenomena. The results of technical and natural threats can be neutralised faster and more effectively with the help of technical means. Sociopolitical threats are harder to predict. Due to their complex nature, it is impossible to precisely determine the likelihood of their manifestation. To neutralise the consequences of such threats or to forestall them, different instruments – political, economic, informational and technological have to be employed, therefore, they must be treated in a very complex and subtle way.

2. ENERGY RESOURCES IN FOREIGN POLICY

Energy resources have become objects and tools of foreign and national security policy. Energy resources in foreign policy can be both the objects of this policy and the instruments used to achieve foreign policy goals. In inter-state relations, energy resources, due to their strategic importance, are the objects of state power rather than only the objects of free trade.[2]

2.1. Use of energy resources in foreign policy

Energy sector elements of national power, accessible to state institutions, are the capacities of the state in the international system seeking to achieve the goals of its foreign policy. The accumulated capacities used in foreign policy become the instruments of foreign policy. The use of energy resources in the foreign policy can be classified according to their impact upon states consumers. In the same way as other foreign policy instruments (military forces, diplomacy, economics), energy resources, applying the classical definition of power relations by Dahl, can be the factors which make the state consumer do something, as "A has power over B to the extent that he can get B do something that B would not otherwise do".[3] Energy resources can also be used to convince states consumers to start implementing the policy preferable by states suppliers. They can be both of persuasive and of coercive nature.

Instruments attributed to the coercive type can be divided into five subtypes according to their impact upon the state consumer: reduction of resource supply (ranging from minimum to total termination) or threats to reduce the resource supply; increase in

[2] Bobo Lo, *Vladimir Putin and the Evolution of Russian Foreign Policy* (Blackwell Publishing, 2003), p. 67.

[3] Dahl, A. Robert, The Concept of Power. *Behavioural Science*, 2:3 (1957: July), p. 201–215.

resource price or threats to increase the price for resources; transit cutback (ranging from minimum to total cutback) or threats to cut back on transit; increase of export duties or threats to do it; requirements to redeem debts or threats to require to redeem debts.

Persuasive instruments are divided into five subtypes: suggestions to decrease the price for resources or decreased prices; suggestions to increase transit or increased transit; suggestions to decrease export tariffs or their decrease; no application of the requirement to cover debts; suggestions to increase resource supply and increased supply.

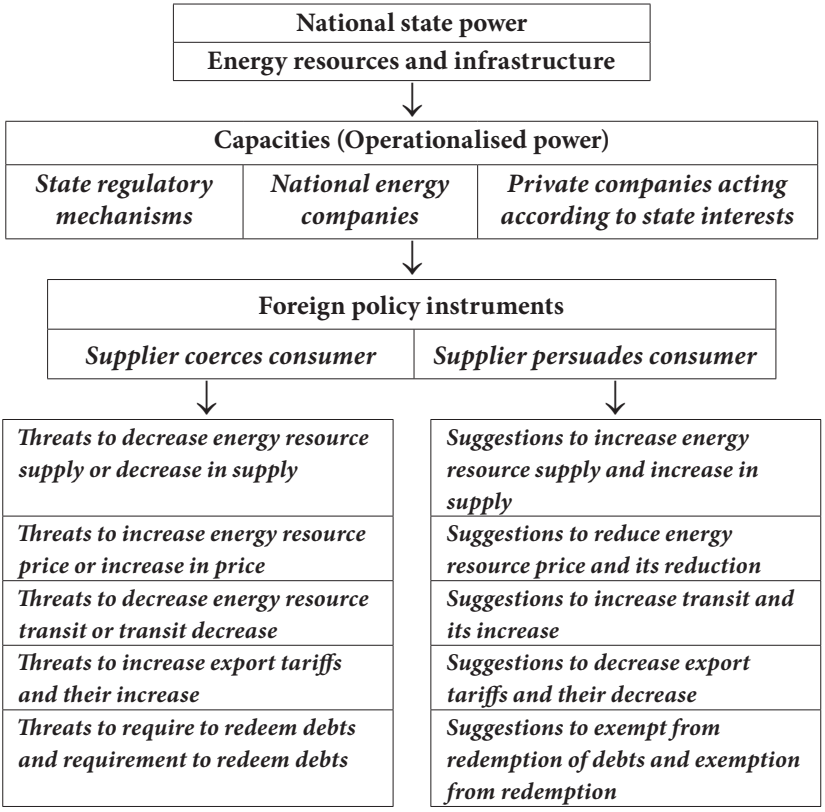

Figure 1. Energy resources as foreign policy instruments

The use of energy resources in foreign policy inevitably exerts impact upon the state they are used against, as well as upon the state that uses them. Consequences can be targeted and untargeted, i.e. intended and unintended, but they are dependent on the instruments being applied. Energy resources as coercion and persuasion instruments for the state which applies them should ensure the attainment of foreign policy goals, i.e., to induce targeted consequences. Foreign policy instruments, irrespective of their specificity, are intended to have impact upon the states':

1. Internal policy processes;
2. Foreign policy conduct;
3. Economic and military capacities.

Energy resources as foreign policy instruments which are attributed to the coercion type can be identified with negative sanctions, they are meant to cause undesirable consequences for states consumers, forcing them to change their internal and foreign policy. The change in internal and foreign policy can also be achieved due to the change in responsible decision makers determined by fights of political groups or societal pressure.

2.2. Factors determining foreign policy effectiveness

Applying energy instruments in foreign policy with regard to various states consumers, the effectiveness can be different. Effectiveness depends on three variables: foreign policy goals; rigidness of the applied instruments (induced consequences for the state consumer) and their intensity; barriers present in a country against which the instruments are used.

Effectiveness of the use of energy instruments is directly related to the aim they intend to help to achieve. The more ambitious the aim is, the more difficult it is to achieve; the consumer will be willing to oppose more intensively and tolerate the negative impact of the instrument longer.

Instruments which exert higher impact force the state to agree with political concessions. It is also important how long the state which applies the instrument can apply it. The longer the instrument is applied, the larger the damage is, and this increases the need to agree with the requirements.

Barriers of infrastructural type allow ensuring geographical diversification of energy resources or power supply and specific fuel diversification. Barriers can be grouped into three types: infrastructural, economic and sociopolitical. Infrastructural barriers also determine how long the state consumer can tolerate interruptions in energy supply. Infrastructure greatly affects geo-energetic positions; its development can decrease the importance of domineering suppliers and market concentration, which in its turn reduces opportunities to apply instruments and effectiveness of their application. However, it is not always that a state consumer can use infrastructural barriers or create them, even under favourable conditions, as opportunities also depend on economic capacities and decisions of responsible decision makers.

Economic type barriers determine the state consumer's possibilities to tolerate the application of energy instruments in foreign policy and ensure alternatives which require higher expenditures (initial – while developing infrastructure, or continuous – ensuring import). Economic barriers determine what increase in energy resource prices and its duration the state consumer can tolerate; it also determines the accumulation of reserve. The nature of energy resource trade conditions is also important; it influences possibilities for energy resource price manipulations. Application of market principles in energy resource trade is the best means of creating economic barriers in energy resource trade and optimal development of economics.

Barriers of sociopolitical nature are essential barriers which determine the success of designing and application of infrastructural and economic barriers and the extent to which a state consumer

intends to take the requirements set by the state supplier into account. These barriers consist of three elements: the position of responsible decision makers; positions of international system agents with regard to the state consumer and state supplier; positions of interest groups in the state consumer.

Positions of responsible decision makers at large determine the strength of infrastructural and economic barriers, as they allocate state finances for the development of infrastructural barriers. It is also necessary to emphasise a high impact of responsible decision makers upon the formation of the state economy structure, which also affects the demands for energy resources and electric power. Decisions made by responsible decision makers also influence the state's response to energy instruments applied against it.

Possibilities to tolerate energy instruments are also affected by the positions of different international system agents with regard to the state consumer and state supplier. Energy instruments will exert higher impact upon the state consumer which receives no support from other international system agents.

Interest groups also exert impact upon responsible decision makers. Pressure from various interest groups is diverse; responsible decision makers encounter increasing pressure coming from business groups which are likely to encourage accepting the requirements of the state supplier. Societal pressure while experiencing the shortage of resource supply will depend on its position with regard to the state supplying energy instruments and its preparation to tolerate the application of these instruments.

Summarising it is possible to state that sociopolitical barriers are most important as they determine the development and strength of other barriers.

3. OPPINION OF LITHUANIAN SOCIETY ON ENERGY SECURITY

Irrespective of a considerably extensive attention of researchers to the energy sector, there is still a lack of explorations into the impact of energy policy upon society. Not only the explanation of socio-cultural assumptions of energy security perception but also the analysis of versatile societal opinion would be of utmost importance here. For instance, what is the citizens' attitude to the energy policy carried out by the state and, meeting the challenges encountered in this area, what are the societal priorities with regard to concrete energy threats or risks and how are the latter represented by the state and, finally, if and how the societal attitude to the situation of energy security in Lithuania changed after the increased Russian aggression in the neighbouring Ukraine? It is answers to some of these questions that are sought for in this part of the overview.

3.1. Energy price and direction of energy policy

One of the issues, which the society is mostly concerned with, is the accessible price for energy resources. A public survey of Lithuanian inhabitants performed in 2013[4] indicated that this aspect of energy security was the most important for the absolute majority of the respondents (89.7 % indicated *important* or *very important*). In this sense, the Lithuanian energy policy aims to obtain energy resources at the lowest prices, complying with the interests of the majority of

[4] The societal opinion was revealed on the basis of two representative surveys of public opinion, which were conducted by the Public Opinion Research Company "Vilmorus". In 2013 the number of respondents was: N = 2002; the age of the respondents was 18 and over. In 2014, the survey was repeated having decreased the number of questions and respondents: N = 1002. In both cases, the results reflect the opinion of all the population of Lithuania and their distribution according to age, gender, place of living, educational background and purchasing power.

the society. Although a number of Lithuanian inhabitants understand that energy independence from Russia is important (71.8 % marked *important* or *very important*), but 68.7 % noted that the "*state has to care more about the low price of energy resources rather than energy security*", and only 30.8 % stated that the "*state has to care more about the energy independence irrespective of the need for higher financial investment*".

When the issue regarding the high price of energy independence arises, 2/3 of the society does not support energy independence. It is evident then that the perception of security and energy policy affect the polarisation of the society. In other words, part of the society would like Lithuania to be less independent of Russian energy supply, but at the same time they do not intend to support this purpose at the expense of their personal well-being. Though energy independence is an important part of energy security, but for the Lithuanian society it remains of a secondary importance in comparison with prices for energy resources.

The research data show that 2/3 of the Lithuanian inhabitants maintain the opinion that the state should first care for cheap energy resources rather than energy independence. Almost ¾ of the inhabitants also consider the price of energy products rather than the amount of their consumption to be energy security. Therefore, it is possible to make an assumption that the greater number of the inhabitants, giving priority to price rather than energy independence, are in favour of materialistic values. Almost ¾ of the inhabitants support the increase of competitiveness rather than agreements and compromise with the monopolist. It could also mean that inhabitants perceive the dependence of energy resources price on the sole supplier. 85.8 % of the inhabitants give preference to ecology with regard to shale gas (see Table 1).

Table 1. Mark the statement you agree with

Statements	%
State should care more about cheap price of energy resources rather than energy independence.	**68.7**
State should care more about energy independence irrespective of more financial investment necessary for it.	30.8
Energy security issue is the price of energy products rather than quantity of their use.	**78.1**
Energy security issue is the quantity of energy product usage rather than their price.	20.7
Increase of competitiveness in energy supplier economy would increase energy security of the state.	**72**
Agreement/compromises with monopolists in the market would increase energy security of the state.	26.3
Priority should be given to environment protection even if it limits shale gas extraction.	**85.8**
Shale gas extraction should be prioritized even at the expense of environment.	13.0
Interests of agriculturalists / private land owners should not limit the development of energy resources.	36.5
Development of energy resources should not interfere with interests of agriculturalists / private land owners.	**62.7**

With regard to human development theory, the priority given to democracy or priority given to energy security, which is related to price, can be defined as a contraposition of intangible (self-expression, aesthetic, emancipation) and tangible (material and physical security) values. The majority of the inhabitants (72.4 %) consider a smoothly functioning democracy to be a condition for energy security, but faced

with the statement contrasting energy security to ensure democratic conditions for the society, the inhabitants split into three groups of similar size (including those who are not aware) (see Table 2). Such division is rather intriguing as it indicates a different understanding of energy security.

Table 2. Evaluate the following statements (%)

	3.1. Smoothly functioning democracy is a necessity aiming at energy security	3.2. To strive for energy security is much more important than to ensure conditions for democracy	3.3. Sometimes actions of political disobedience (e.g., protests) are inevitable in order to attract proper government's attention to energy security issues citizens are concerned with	3.4. In some cases state has to employ coercion in order to realise energy security goals
Totally disagree	1.1	4.5	2.7	12.9
Disagree	5.6	33.5	10.0	38.9
Agree	57.7	27.2	52.0	22.0
Totally agree	14.7	6.4	15.7	3.3
Not aware	20.8	28.3	19.6	22.9

Energy security is important for the society, and this is shown by almost 2/3 of the inhabitants who agree that sometimes it is necessary to undertake civic (a democratic attitude) disobedience in order to attract attention to energy security issues; furthermore, more than half of the respondents disagree with the statement that government needs to employ coercion to implement energy security goals. It is obvious that the respondents relate democracy to energy security rather than oppose these two variables.

3.2. Lithuanian and Russian energy policy evaluation

As mentioned above, while conducting the research two Lithuanian public population surveys were performed: one in 2013, the other, having selected only part of the questions – in 2014. The second survey was performed due to the changed situation in the region where Lithuania belongs to – Russia occupied the Crimea and started the war against the Ukraine. It is possible to state that after the Crimean occupation, a societal attitude towards energy policy of Lithuanian government and Russia changed. Lithuanian inhabitants started valuing Russian energy policy with distrust, and Lithuanian energy policy attracted more positive evaluations (see Table 3).

Table 3. Societal attitude to Lithuanian and Russian energy policy before and after the Crimean occupation (%)

	Lithuanian energy policy is positive (before)	Lithuanian energy policy is positive (after)	Russia is using energy to keep Lithuania in its area of influence (before)	Russia is using energy to keep Lithuania in its area of influence (after)	Lithuanian energy policy seeks to limit Russian interests in Lithuania (before)	Lithuanian energy policy seeks to limit Russian interests in Lithuania (after)
Totally disagree	5.5	6.4	3.8	4.0	2.2	2.6
Disagree	27.1	26.8	13.3	14.2	12.6	12.9
Agree	31.5	37.1	44.2	47.4	41.1	46.6
Totally agree	2.8	3.2	11.1	13.8	7.5	8.7
Not aware	33.1	26.4	27.5	20.7	36.6	29.2

The survey performed in 2013, i.e., before the Crimea occupation, showed that 14.8 % of the respondents disagreed with the statement that "*Lithuanian energy policy seeks to limit Russian interests in Lithuania*", 48.6 % agreed and 36.6 % were not aware. Whereas the survey conducted in 2014 showed that 15.5 % of the respondents disagreed with this statement, even 55.5 % agreed and the percentage of those who were not aware was 29.2 % (see Table 3).

Summarising the data it is possible to state that the Crimean occupation exerted the most impact upon those who were not aware how to respond to the statements about the Russian and Lithuanian energy policy. With regard to all three statements, the percentage of those who approved of the Lithuanian energy policy and valued the Russian policy negatively has increased; whereas the percentage of those who disagree that Russia is using energy to implement its interests in Lithuania as well as the percentage of those who value Lithuanian energy policy negatively has changed only slightly.

3.3. Shale gas evaluation before and after the Crimean occupation

Comparing the data of both surveys with regard to the attitude to shale gas extraction, certain changes after the Russian occupation of the Crimea are also evident. The data of the 2013 survey showed that 25.8 % of the respondents agreed with the statement "*I think that shale gas extraction is economically useful for Lithuania",* 31.6 % disagreed and 45.6 % were not aware of the response. While in the 2014 survey, already 38 % of the respondents agreed with the statement, 28.4 % disagreed and 33.6 % were not aware.

Table 4. Societal attitude towards shale gas extraction before and after the Crimean occupation (%)

	Shale gas extraction is economically useful for Lithuania (before)	Shale gas extraction is economically useful for Lithuania (after)	Shale gas extraction is ecologically secure (before)	Shale gas extraction is ecologically secure (after)	Shale gas extraction will increase Lithuanian energy security (before)[5]	Shale gas extraction will increase Lithuanian energy security (after)
Totally disagree	13.1	7.3	17.6	8.2		6.4
Disagree	18.5	21.1	24.7	28.0		21.3
Agree	22.8	32.9	12.4	21.4		30.9
Totally agree	3.0	5.1	1.5	3.5		5.7
Not aware	42.6	33.6	43.8	38.9		35.7

Thus, it is evident that the attitude to shale gas extraction of some of the respondents has changed. An analogous situation is observed with regard to the statement *"I think shale gas extraction is ecologically secure"*: before the Crimean occupation, 13.9 % of the respondents agreed with this statement, 42.3 % disagreed and 43.8 % were not aware. After the Crimean occupation 24.9 % agreed, 36.2 % disagreed and 38.9 % were not aware. Taking into consideration that objective knowledge about the ecology of shale gas extraction could not have changed, it is possible to assume that the impact of the Crimean occupation by Russians could have changed the attitude

[5] This question was not included in the 2013 questionnaire.

of part of those who were not aware about the ecology of shale gas extraction. The percentage of the respondents who totally disagreed that shale gas extraction was ecologically secure has decreased from 17.6 % before the occupation down to 8.2 % after the occupation.

3.4. Perception of Lithuanian energy security problem solution

After the Crimean occupation, Lithuanian inhabitants' dispositions also changed with regard to such phenomena, which seem unrelated to the Russian threat. In 2013, considering the statement *"Energy security problem is solved in Lithuania taking into account the interests of all social groups"*, 62.3 % disagreed, 16.3 % agreed and 21.4 % were not aware. Whereas in 2014, 58.5 % disagreed with the statement, 21 % agreed and 20.6 % were not aware. In 2013, on the contrary, 9.3 % disagreed with the statement: *"Energy security problem is solved in Lithuania taking into account only the interests of the most powerful interest groups"*, 70.8 % agreed and 19.8 % were not aware. After the Crimean occupation, in 2014, 14.2 % disagreed with the statement, 64 % agreed and 21.9 % were not aware.

Thus after the Crimean occupation part of the inhabitants changed their opinion thinking that energy security issue in Lithuania is solved taking into account the interests of all social groups. On the other hand, although the percentage of supporters of this idea increased, their number is rather low, and it is obvious that a great part of the society support the opposite idea agreeing that energy security problems are solved taking into account the interest of the most powerful interest groups.

Table 5. Whose interests are taken into the consideration while solving Lithuanian energy security problems? (%)

	Energy security problem is solved in Lithuania taking into account the interests of all social groups (before)	Energy security problem is solved in Lithuania taking into account the interests of all social groups (after)	Energy security problem is solved in Lithuania taking into account only the interests of the most powerful interest groups (before)	Energy security problem is solved in Lithuania taking into account only the interests of the most powerful interest groups (after)
Totally disagree	14.1	10.8	1.3	2.5
Disagree	48.2	47.7	8.0	11.7
Agree	14.3	17.1	45.1	46.3
Totally agree	2.0	3.9	25.7	17.7
Not aware	21.4	20.6	19.8	21.9

4. THE LITHUANIAN ENERGY SECURITY LEVEL IN 2007–2013

The overall security level of the country can only be assessed with regard to all factors influencing energy security. There are more than 60 factors (indicators). All of them are divided into three blocks – technical, economic and socio-political. Each block and each indicator have their value in the overall estimate that integrates the influence of all factors for energy security. This estimate is called the energy security level (measured in the scale from 0 to 100 %).

4.1. The overall level of Lithuanian energy security

The assessment of Lithuanian energy security level has started since 2007 when the energy security level reached 53.5 % in comparison to the maximum – 100 %. Over the past years, the highest security level was achieved in 2008 – 55.6 %, and the lowest was noted in 2011 – 51.0 %.

In 2010, the situation in the energy sector changed due to shut down of Ignalina NPP, because the prevailing resource of electricity energy production also changed – basic production of electricity was ensured by power plants fuelled with gas. Gas supply is the most sensitive to economic and geopolitical factors; therefore, the domination of this kind of fuel in the energy production process has significantly reduced the energy security level.

When assessing the overall level of energy security, all indicator results are added up; therefore, the worse situation in one energy security sector is partially compensated by better results from another sector. Still, indicators signifying a critical state show that there are essential problems in the energy sector necessary to be solved. Starting with 2010 indicators of economic and technical blocks, related with nuclear power production and fuel supply are not counted, because at the end of 2009 Ignalina NPP was shut down.

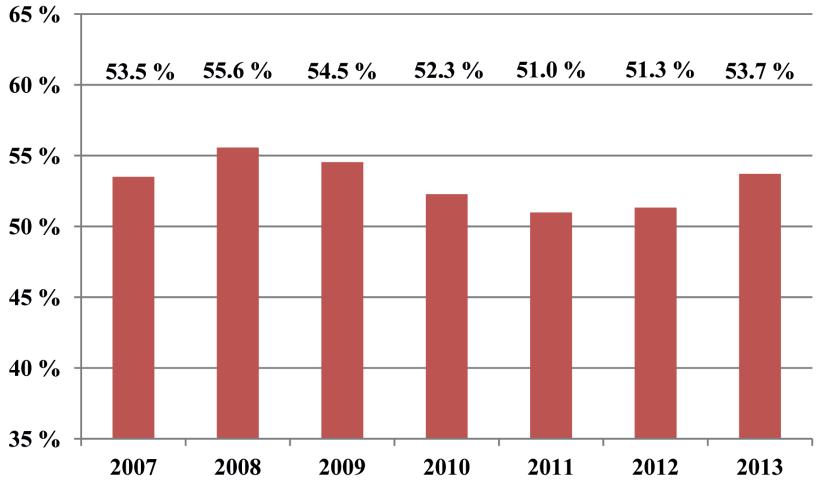

Figure 2. The dynamics of energy security level in 2007–2013

Starting from 2009, a major part of indicators fall into pre-critical condition and less than one third – into normal condition. Such distribution of indicators shows a significant negative influence on the overall energy security level.

Table 6. Distribution of indicators according to conditions

Year	2007	2008	2009	2010	2011	2012	2013
Critical condition	22	21	21	17	17	19	17
Pre-critical condition	21	22	24	24	25	23	26
Normal condition	25	25	23	19	18	18	17

Most of the indicators falling under the category of critical condition are connected with the gas system: the ratio of gas buying price with the average buying price in the EU countries, the amount

of gas bought from the biggest supplier, high electricity and heat energy production dependency from gas. A number of indicators get into the critical zone due to the lack of market conditions, especially in the heat production sector. The socio-political block of indicators shows that the greatest negative influence on energy security is caused by Lithuania's high dependency on import from one country and disproportionally high expenses of inhabitants for energy services in comparison to average income, as well as the negative attitude of population to new energy projects and low political rating of the countries under research.

4.2. The energy security level of the technical block

The energy security level in the technical block in 2007–2013 changed from 63.3 % to 60.8 %. Technical area is the strongest part of Lithuanian energy sector. High and often surplus energy production capacities, well developed network for energy transmission and distribution, an opportunity to use alternative fuel for production equipment allow to maintain that the technical aspect of Lithuanian energy sector satisfies the country's energy security needs. The situation is worsened by the old energy production equipment age and concentration of energy production in gas fuelled power plants using a small number of technologies. Due to natural obsolescence of equipment, the indicators of the technical block are somewhat lower, but with the introduction of new equipment and technologies the energy security level in the technical block will increase.

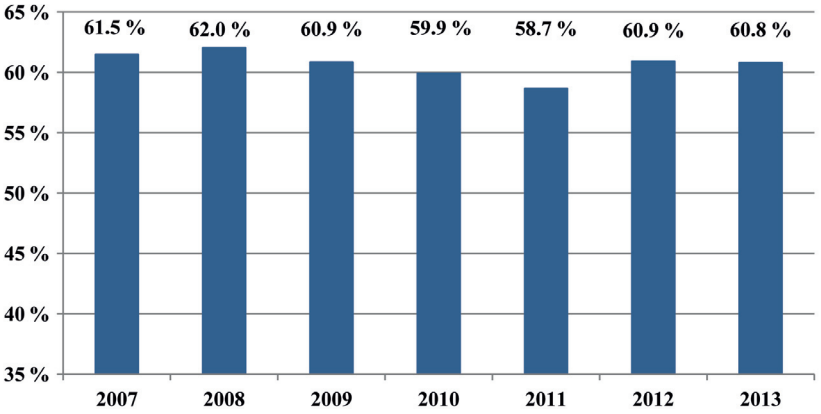

Figure 3. The dynamics of energy security level in the technical block in 2007–2013

4.3. The energy security level of the economic block

In the period under analysis, the economic block energy security level increased by 8 percentage points, and in 2013 it reached 49.2 %. The improved situation in district heating had the greatest impact. Still, the level of this block of indicators is the lowest of all indicator blocks. The main indicators of the economic block signifying the critical condition are connected with the gas sector, the forming concentration of biofuel suppliers and with imported energy resources. The dynamics of the energy security level of the block is demonstrated in the fourth figure.

The overall growth of the security level of the block is connected with the development of free markets in the energy sector, first of all in the system of electricity. A very large part of electric energy import has reduced the overall level of the block since 2010, but after Lithuania have joined "Balt Pool" energy exchange mechanism, the growing use of biofuel and the formation of the biofuel market compensated the decrease and create the potential for the rise of block's security level.

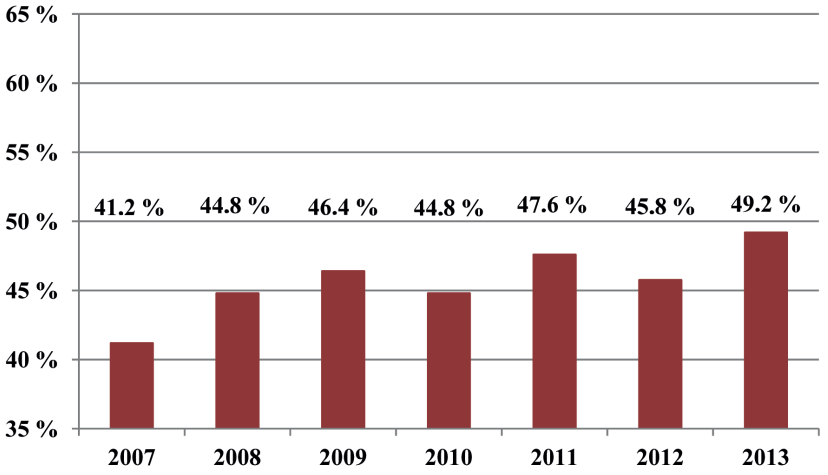

Figure 4. The dynamics of energy security level in the economic block in 2007–2013

4.4. The energy security level of the sociopolitical block

Lithuanian energy security level in this block in the period of 2007–2013 was marked by obvious decreasing tendencies. The overall security level of the block in 2008 was 57.1 % and in 2012 – only 47.0 %; the security level decreased by 10.1 % and almost equalled the security level of the economic block. However in 2013, the situation improved to a certain extent, and the level increased by 4.1 percentage point. This resulted due to improved Lithuanian political risk factor (International Country Risk Guide), published by the agency PRS Group. Still, in a longer period of time, the energy security level of the block should acquire the tendencies of growth in relation to the implementation of energy projects. The dynamics of the block energy security level is illustrated in the fifth figure.

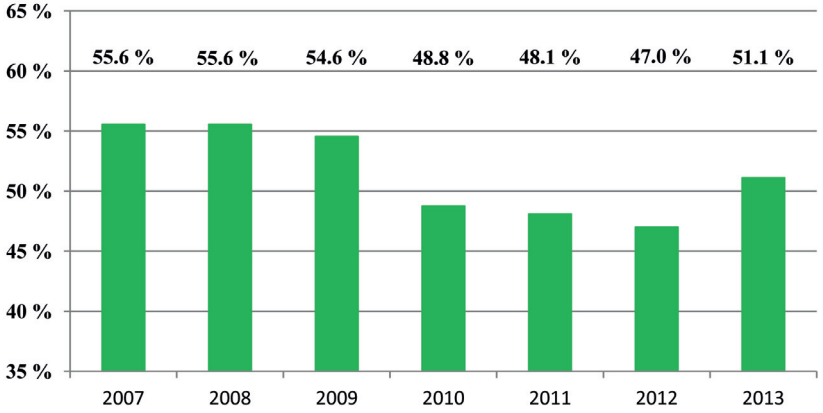

Figure 5. The dynamics of energy security level in the sociopolitical block in 2007–2013

The overall decrease of the energy security level of this block is connected with the growing import of energy resources, import dependence on one state and the increasing part of the population income devoted to covering heating and electricity. The overall security level of the block slightly increased due to the obligations for energy saving, but this indicator also showed the critical condition.

5. THE COMPARISON OF THE LITHUANIAN ENERGY SECURITY LEVEL WITH THE LATVIAN AND ESTONIAN ENERGY SECURITY LEVEL

To compare Lithuanian energy security level with other countries in this survey, the energy security level of Latvia and Estonia was assessed using the same methodology. The received data are presented in Table 7. These results show that the energy security levels in Latvia and Estonia are higher than in Lithuania. The security level in Estonia falls under the normal condition and in Latvia is close to the normal condition.

Table 7. The dynamics of energy security level

Year	2008	2009	2010	2011	2012	2013
Lithuania	55.57 %	54.54 %	52.28 %	50.98 %	51.33 %	53.71 %
Latvia	62.83 %	63.20 %	59.69 %	60.92 %	60.80 %	62.25 %
Estonia	66.37 %	67.18 %	64.89 %	66.54 %	65.17 %	66.39 %

All three countries are in the similar environment of threats and risks. Significant differences in energy security level are decided by technical and economic blocks. As has been mentioned, the indicators denoting a critical condition in the economic block are mostly those connected with the gas sector. A similar situation exists in Latvia and Estonia. Still, during the assessment of the energy security level of the three Baltic States, differences emerge mostly related to the part of the gas sector in the energy balance of the countries. In the energy security level of Lithuania, the gas sector takes up about 31 %, in Latvia it amounts to 16 %, in Estonia – 7 %. The biofuel sector receives the best assessment in all three states. In Lithuania and Estonia it makes up about 21 % and in Latvia – almost 39 % depending on the energy security level.

Table 8. Average group values in the technical and economic blocks of the Baltic States

	Lithuania	Latvia	Estonia
Electricity	19.04 %	21.44 %	34.35 %
Gas	30.96 %	15.78 %	7.06 %
Oil	4.17 %	0.18 %	0.49 %
Coal	3.72 %	3.12 %	4.61 %
Biofuel	21.21 %	39.00 %	21.46 %
Heating	20.90 %	20.48 %	32.02 %

The energy security level in Latvia increases due to two reconstructed blocks of Combined Heat and Power Plants in Riga and gas depository in the country. Estonia is the exporter of electricity, and electricity is produced by using country's own resources. These factors are exceptionally favourable for the Estonian energy security.

6. TENDENCIES OF THE LITHUANIAN ENERGY SECURITY IN DIFFERENT DEVELOPMENT SCENARIOS

Energy security can be evaluated not only from the past data or at present moment, but also in different time perspective, identifying variation of the energy security in the future. This requires consideration of various development scenarios of energy sector and comparison of these scenarios from the energy security perspective. Methodology, which is characterized by the identification of threats and disturbances to the energy system, modelling of perspective development of the energy system using economic-optimisation model with different stochastic disturbance scenarios and calculation of energy security coefficient (ESC), which is used to assess disturbance consequences to the energy system – possibly unsupplied energy and energy cost increase due to disturbances, is applied to evaluate tendencies of Lithuanian energy security for different development scenarios. Energy security coefficient (scale from 0 – minimal ESC to 1 – maximum ESC) evaluates level of energy system resistance to disturbances. Variation of energy security coefficient for each development scenario or average ESC for different periods is obtained by calculating the coefficient values.

Analysis consists of total five major development scenarios of Lithuanian energy sector in the medium-term (2015–2030) perspective.

In order to compare the tendencies of the Lithuanian energy security in different development scenarios with one integral characteristic, an integral average ESC of the whole modelling period is calculated. It enables for a desirable period to evaluate average ESC values of various energy sector development scenarios and compare these values.

Table 9. Development scenarios of the Lithuanian energy sector chosen for modelling

Scenario notation	Scenario name	Scenario description
SC1	Basic	Nothing new is done and energy sector is developing as the basic scenario, electricity import is dominating to meet the electricity demand in this scenario.
SC2	Nuclear power plant (NPP)	From 2023, a new nuclear power plant is in operation. Share of the unit capacity and investments are considered only for Lithuania, which according to the market is 47.5 %, while capacity is 657 MW.
SC3	Renewable energy sources (RES)	Installed capacity of renewable energy sources in 2018 begins rapidly increasing until 2025 achieves a level that is twice higher than is predicted for that year.
SC4	Combined cycle blocks (CCB)	Gas combined cycle block (450 MW) from 2018. Gas combined cycle block (450 MW) from 2025.
SC5	Combined cycle blocks (CCB) and nuclear power plant (NPP)	Gas combined cycle block (450 MW) from 2018 and nuclear power plant (657 MW) from 2023.

Table 10. The comparison of energy security coefficient of the analysed Lithuanian energy sector development scenarios in different periods

Energy security coefficient	SC1 Basic	SC2 NPP	SC3 RES	SC4 CCB	SC5 CCB & NPP
2015–2025	0.774	0.795	0.803	0.811	0.818
2015–2030	0.733	0.790	0.769	0.794	0.811

After the average values of ESC in the analysed development scenarios are defined, an advantage of the fifth scenario is noticed, compared to other scenarios, because the ESC value of the fifth scenario is the highest of all the modelled scenarios in the period 2015–2025 as well as in the period 2015–2030. These results also unfold the importance of time moment of the implementation of development project in the energy sector. Comparing the analysed scenarios with each other, it is clear that the CCB and NPP (the fifth) scenario is "best" in terms of energy security, especially in the longer period.

Since the first development scenario corresponds to the basic scenario of the Lithuanian energy sector, a comparison with other analysed scenarios is possible in the sense of priority to the first. The sixth figure shows changes of energy security coefficients of four scenarios in percent compared to the first scenario. Newly implemented development projects would increase energy security coefficient from 3.62 % in the case of the rapid development of renewable energy sources scenario to 7.82 % in the case of combined cycle block and nuclear power plant scenario in 2015–2030. In the case of other two scenarios, ESC would increase approximately by 6 % during the same period.

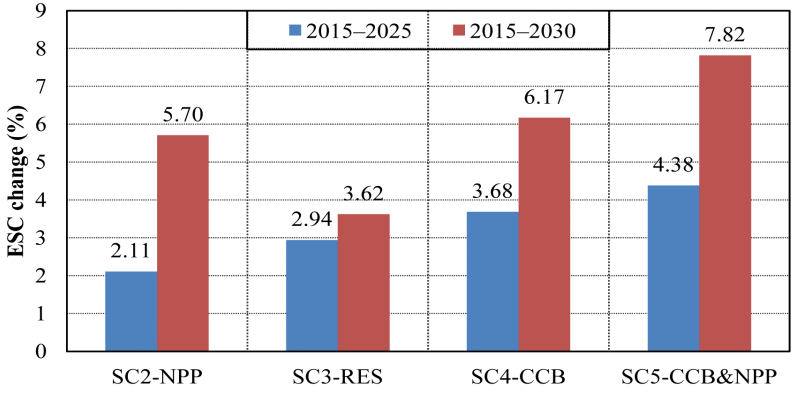

Figure 6. Change of energy security coefficient compared with the first scenario in the medium-term perspective

Energy security of the Lithuanian energy sector development scenarios based on various energy production technologies is different and considerably depends on energy production and import ratio. Furthermore, the development scenarios based on the dominant electricity import (SC1) or only on the renewable energy sources (SC3) would ensure lower energy security in the perspective until 2030 in comparison with alternative scenarios, according to which basic electricity generation is implemented in the newly built combined cycle blocks or at the new NPP. The SC5 scenario ensures the most stable security since the production of electricity is more diversified, together with the renewable energy sources we have gas power plants of combined cycle with a reliable supply of fuel from the LNG terminal and a new NPP ensuring basic electricity generation.

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