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Energy Security Research Center

LITHUANIAN ENERGY SECURITY

ANNUAL REVIEW 2012–2013

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ENERGY SECURITY RESEARCH CENTRE

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ANNUAL REVIEW 2012–2013

VYTAUTAS MAGNUS UNIVERSITY
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FOREWORD BY THE HEAD OF THE ENERGY SECURITY RESEARCH CENTRE

Lithuania has entered the third decade of its independence and over this period it has been consistently heading in the direction of security assurance. Having joined NATO and the European Union, the United Nations, the World Trade Organisation, as well as the Schengen Area and other European and world organisations, Lithuania has ensured the development of democracy, sovereignty, security, control of boarders and the air space and has acquired other guarantees of the state security. Still, it turned out that the achievement of energy security is a significantly slower and more complex process.

Though all governments, presidents and members of Seimas of different tenures have made every effort to ensure energy security, the present day Lithuania remains the energy island of the European Union. Lithuanian citizens and businesses still pay one the highest prices for gas, our renewable energy resources are making their way arduously, the projects of building renovation are not gaining the momentum. Still, there are certain positive changes in the process of energy security assurance, such as Lithuania joining the North and Baltic countries' power market "Nord Pool Spot", the beginning of the Third Energy Package implementation, active resistance against the "Gazprom" dictatorship, certain amendments of Lithuanian laws and other, mostly organisational activities.

Nevertheless, there are reasons for great optimism and big hopes. These are the energy projects Lithuania's energy security that are being prepared or have already started. First of all, it is the liquefied natural gas terminal in Klaipėda. The emerging shape of this project acted as an incentive for "Gazprom" to start a dialogue with Lithuania. The projects of electricity interconnections with Sweden and Poland should also be assessed positively – though criticised, they are continued by a subsequent

governments. It proves that continuous projects lasting longer than one political term have the potential in Lithuania and it strengthens the belief that our country can undertake activities integrating Lithuanian energy systems with the system of the European Union.

Unfortunately, our major problems with energy sector that are resistant to solution as they can no longer be measured by one parameter – economic, technical or political, cannot be left out. All assessments have to be included into one denominator and it means a significantly more serious process as compromises and common agreements are necessary. In 2010, after the Ignalina nuclear power plant was shut down, it seemed that Lithuania is determined to remain the state of nuclear energy and even to be a leader in the region inviting Latvia, Estonia and Poland to build a new nuclear power plant. Regrettably, the agreement about the construction of Visaginas nuclear power plant has still not come into effect, though we have a strategic investor and power plant constructor – the "Hitachi" company, as well as the prepared construction sight. The development of the nuclear power plant in Astraviec region (Belarus), to some extent a competitor in the region, has started. The efforts to persuade the neighbours and the inhabitants of Lithuania in the necessity of the Visaginas nuclear power plant so far have not been successful. There is a lack of strength to take up the role of the leader of this project. The solution of another issue – connecting Lithuanian (together with other Baltic States) electricity network with the European Continental Network in the synchronous mode so far has not made headway. The political aspect of this problem is clearer than in the case of the Visaginas nuclear power plant, but the technical and economic parts have not been thoroughly evaluated.

Not all steps in the energy security reinforcement process are smooth and easy. It turned out that Lithuanian enthusiasm in connection to solar energy was overrated. The excessively generous support for this field was threatening to cause renewable resources market distortions and inadequate burden for consumers. Last year solar energy framing

programmes had to be revised. The creation of the free market of independent heat producers in the big cities of Lithuania is also facing obstacles. Defending themselves with gaps in the laws, new independent heat producers adapt their prices to the ones of the existing producers though their net costs are significantly lower. It inhibits the development of the market of heat producers and discredits it. Other issues of concern are the unabated import of electricity and the renovation of buildings that is still stuck in the project adjustment stage. We also do not have a new energy strategy that would correspond with the reality of the present day Lithuania and the EU.

The present publication is the second annual report of the energy security research centre. Applying the earlier created methodology, the overall Lithuanian energy security level was assessed and the influence of possible energy development scenarios on energy security was analysed. In 2013 a comprehensive poll of Lithuanian inhabitants was carried out on the topics of energy security. The generalised results of this poll, together with the first assessments of the energy security level in our neighbouring countries – Latvia and Estonia, as well as the comparison with the situation in Lithuania are presented in this publication.

We hope that this review will allow the readers to develop overall understanding of the problem of energy security, will enable them to compare their assessment with the results of the report and invite for discussion and search for solutions.

Prof. Juozas Augutis

1. THE CONCEPT, CLASIFICATION AND CHARACTER OF THREATS FOR LITHUANIAN ENERGY SECURITY

In order to assess energy security, it has to be defined first. The definition helps to identify parameters and factors conditioning energy security, as well as to determine threats inhibiting the achievement of a higher security level.

1.1. The concept of threats for energy security

Threats for energy security are real opportunities to cause damage or reduce the overall energy security level. In order to determine the threats for energy security, conditions ensuring energy security have to be identified. Not meeting these conditions is defined as energy insecurity. Manifestation of threats reduces energy security and affects other security sectors.

The absence of energy resources supply alternatives is considered to be a threat for energy security as it can result in interruption of the energy resources supply. Lack in energy resources supply alternatives influences the political and economic security sectors of the state, because state leaders and economy subjects need to take the interests of the energy resource provider into consideration and it has a direct effect on political or economic processes.

The sources of threat can be of social, natural (climatic) or technogenic character. Threats are divided into purposeful and inadvertent. Purposeful threats occur when specific individuals attempt to cause damage; therefore all of them are of social 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. Inadvertent 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 countries consumers:

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

In order to protect from threats to energy security, states create barriers – factors blocking the threats, diminishing their consequences or shortening the duration. Barriers are grouped into:

- Technological barriers: reliability of infrastructure, varietal and geographic diversification of resources, energy effectiveness;
- Social barriers: political positions, social positions, 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 strength.

1.2. The analysis of threats for Lithuanian energy security

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

1.2.1. Technogenic threats for Lithuanian energy security

Technical accidents in the energy production, resource transportation and energy transmission infrastructure. Threats for energy security can manifest in accidents of pipelines, product supply systems, oil terminals, gas pipelines and electricity network and their effect on energy security as well as on other sectors of security 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, all oil products would have to be imported and budget income would be significantly lower. The likelihood of such accidents is fairly small.

High energy intensity. It has a permanent negative effect on the equipment reliability and determines higher dependability on importers. Since 2004 energy intensity in Lithuania has been decreasing, but still remains two times higher than the EU average or the average of countries in a similar climate zone.

Inflexibility of the energy sector (adaptation to use only specific energy resources). The threat in Lithuania manifests itself in oil and natural gas systems. "Orlen Lietuva" oil refinery is adapted to process oil that has no less than 90 % of "Urals" type oil. Gas import, necessary to satisfy Lithuanian economic and social needs, is only possible via gas pipeline Minsk (Belorus) – Vilnius; natural gas could be also imported via Riga (Latvia) – Panevėžys gas pipeline, but it would not satisfy all the consumer needs.

1.2.2. Social threats for Lithuanian energy security

Corruption. The level of corruption inside the country, as well as in the supplier and transit countries is significant for energy security, as the disturbances in resource supply and increase of prices could be de-

cided by corruption factors. Corruption manifests itself as a latent[1] type threat, for example, as resource supply disruptions, price increase, and absence of barriers to threats caused by indirect purposeful acts. The level of corruption in Lithuania is decreasing, but remains high in Russia – the main energy resource exporter and Belarus – the 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 among the highest in the world. The excise for natural gas that has been introduced in Lithuania since 2014 will make up 2 % of the gas price.

Environmental requirements. On the one hand, these requirements have a positive effect on the living environment, but, on the other hand, the threat of environmental requirements manifests itself when the regulatory mechanisms limit extraction and consumption of certain kinds of fuel thus reducing the number of opportunities to increase the potential of local extraction and diversify energy resources geographically, as well as according to types of fuel. The growing price for CO_2 emission 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 two times lower in comparison to coal.

Low quality of the consumer state and supplier states administration. This threat has a constant effect which may have rather negative consequences for energy security. At the national level it may cause interruption in supply and the increase in price if activities are connected with individual political interests; it also influences the manifestation of political interests through termination of energy resource supplies or imposing sanctions. Lithuania is attributed to countries

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

with a relatively high quality of administration. The administration quality in Russia – the main energy resource exporter and Belarus – the transit state is lower.

High concentration in the energy sector market or formation of monopolies. Dependence on a small number of suppliers, absence of infrastructure alternatives and poor diversification of resources pose threats for the stable energy resource 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 resource 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 resource and electricity supply infrastructure, as well as energy production and resource processing infrastructure situated outside the country boarders. Attacks are also possible in cyber space.

Resistance of society to energy projects. This threat receive rather controversial assessment. On the one hand, the public opinion presenting a negative approach to new energy projects is expressed democratically 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 information for society about the prospective projects, the influence of the groups of interests, emergence of monopolies, high financial investments at the beginnings of the projects and other.

Aggressive policy of supplier states against the consumer state. Aggressive policy of the supplier state can be demonstrated through inter-

ruptions in energy resource 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.

The disruption of energy resource supply because of disorders in the transit chain. This kind of threat manifested itself in the Lithuanian gas system. The likelihood of the threat increases significantly during negations of transit prices.

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

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

1.2.3. Natural (climate) threats for Lithuanian energy security

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 power lines, movement of the ground because of the frost and etc.

Due to notably low temperatures and poor quality of pipelines, most centralised heating consumers may experience disturbances in heat energy supply. Technical accidents may also happen, as well as the increase in the demand of natural gas. The demand for electricity, increased because of exceptionally high temperatures may cause the overloads. The rise of demand also encourages the sharp rise of price of in the electricity market.

Extreme wind, precipitation, 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 disruptions of electricity supply. Lithuanian wind energy park is growing and the opposite phenomenon – absence of the wind negatively affects 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. Social threats are less predictable. Due to their complex nature, it is impossible to precisely determine the likelihood of the threat manifestation. To neutralise the consequences of such threats or to forestall them different instruments – political, economic, informational and technological have to be employed. Threats of social character have to be treated in a complex way and models of action have to be created.

2. SOCIOLOGICAL ENERGY SECURITY RESEARCH

In order to assess technical, economic and socio-political consequences caused by energy interferences, a representative public poll "Public opinion on energy security" was conducted in 2013.

2.1. Social concept of energy security

To find out what aspects of energy security are the most important in the public opinion, respondents were asked to assess the main aspects distinguished by the experts. Figure 1 demonstrates several emerging tendencies:

- All the given energy security aspects are important or even very important. 'Energy resource price' (89.7 % – important or very important) and 'Reliability of energy service provision" (87.9 % important or very important) are especially prominent.
- The survey showed the continuing ambiguous evaluation of nuclear energy. Almost a quarter (24.1 %) of respondents indicated that 'the development of nuclear energy' is completely unimportant or not important for Lithuanian energy security. Almost half of the respondents (49.1 %) think that this aspect is important or very important and a little more than a quarter (26.8 %) are undecided in connection to this question.
- The development of shale gas extraction has received the most ambiguous assessment. Almost one third of the respondents (28.6 %) think that this aspect is not important or is completely unimportant for Lithuanian energy security. A little more than one third of respondents (31.7 %) are undecided in connection to this question and only 39.7 % consider this aspect to be important or very important.

It is quite obvious that society lacks information about certain Lithuanian energy security aspects that are not often mentioned publicly or are more specific. For example, about one fifth of the respondents are undecided in connection to the development of oil extraction, energy resource diversification, integration into common EU energy market and ability to use international political relations (e.g. EU, NATO) for the defence of the interests of Lithuania.

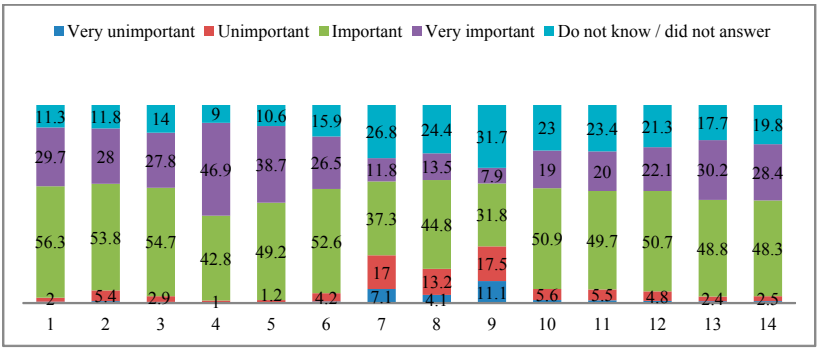

Figure 1. The importance of energy security aspects for Lithuania

1. The reliability of energy infrastructure (pipelines, transmission networks, electric power stations etc.); 2. Energy independence from other countries; 3. The development of renewable energy; 4. The price of energy resources; 5. The reliability of energy service provision; 6. Independent energy production; 7. The development of nuclear energy; 8. The development of oil extraction; 9. The development of shale gas extraction; 10. Diversification of energy resources; 11. Diversification of energy suppliers; 12. Integration into the common EU energy market; 13. Implementation of modern technologies in the energy system; 14. Ability to use international political relations (EU, NATO) to protect the interests of Lithuania.

2.2. The assessment of consequences for society caused by changes in the energy sector

The main energy sector threats – disturbances in energy product supply and energy product price increase – from the society insecurity increase standpoint have a similar effect. The survey showed that the respondents are affected "the most" by obstructions in electricity supply and the increase of electricity price. In their opinion, the damage caused by interference in hot water supply and the increase of its price would be not so significant. Obstructions in heat supply and the increase of its price was also considered a problem causing major damage; even greater damage, according to respondents, could be caused by disturbances in fuel (petrol, diesel fuel, gas, solid fuel) supply and the increase in its price.

Due to centralised energy systems absolute majority of the society have minor possibilities to protect themselves from various energy threats. The society is especially sensitive to the increase of the electricity price – even 84.9 % of respondents indicated that they have low or very low possibilities to protect themselves from this threat. The rise of fuel (petrol, diesel fuel, gas, solid fuel) prices is also painful – 82.1 % of respondents said that they have low or very low possibilities to protect themselves from this threat.

The problem of centralised heating supply is also acute – only 15 % of the respondents have high or very high possibilities to protect themselves from this type of threat. The problematic character of centralized heating supply, according to the majority of the respondents, is more connected with the increasing price of the service and not so much with the disturbances in supply. The answers to the questions "What would be the damage caused to you by the disturbance in heating supply?" and "What would be the damage caused to you by the increase of the heating price?" were the following: to the first question – 69.3 % – large or very large (22.2 % – small or very small) and to the second question – 77.6 % –large and very large (14.5 % – small or very small).

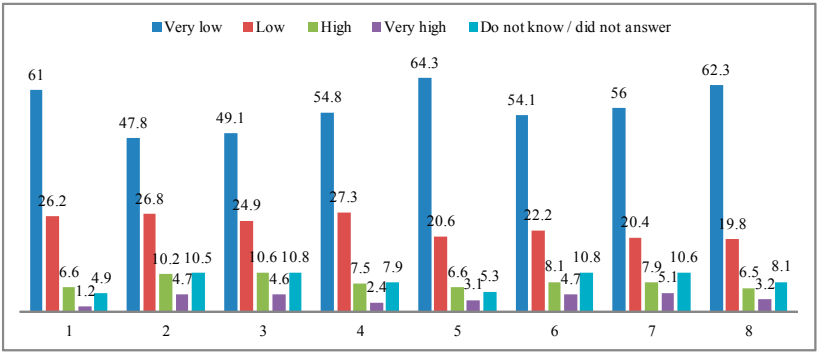

Figure 2. Assessment of opportunities to prevent energy threats

1. Disturbances in energy supply; 2. Disturbances in hot water supply; 3. Disturbances in heating supply; 4. Disturbances in fuel supply; 5. The increase of electricity price; 6 The increase of hot water price; 7. The increase of heating price; 8. The increase of fuel (petrol, diesel fuel, gas, solid fuel) price.

2.3. The analysis of the energy policy from the governmentality theory viewpoint

The interpretation of the poll data from the governmentality theory viewpoint, leads to partial explanation why a variety of state energy policy activities are misunderstood or unaccepted by a part of population. The governmentality theory defines the emergence of a special governance form, disciplinary and regulating in connection to inhabitants, in the present society. It is also called late modernity or neoliberal society. These forms of governing are not characterised by direct and forced application of power, as first of all they strive for internalising certain ways of thinking and behaviour in the society. Governmentality has to be grounded by supply of selective information and supported by credible policy makers. Governmentality is like common mentality of all modern government forms expressed by a

harmonious collection of institutes, procedures, research, reflections, calculations and tactics that allows the application of a very specific and complex form of governing. Therefore, in order to make certain energy policy (e.g. shale gas extraction, Visaginas nuclear power plant and other energy projects), it necessary to present to the population the information that would be arranged in a certain way and would be positive. Still, the results of the poll show that most of the society members have vague understanding about the present-day policy of Lithuanian energy policy. 18.3% of the respondents agreed or absolutely agreed with the statement "I am very well informed about the energy problems". Inhabitants also know very little about the main energy policy makers (see Fig.3.).

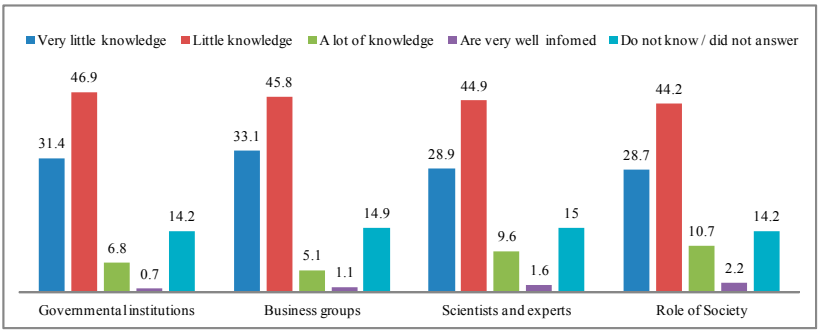

Figure 3. The knowledge of the Lithuanian inhabitants about the formation of energy strategy and the functions of various government institutions, business groups, scientists/experts and the society

Researchers applying the governmentality theory to explain the society behaviour notice that governance of neoliberal societies employing different risks of modern life, in this case these are energy threats, and their calculations, involve the society into energy policy management as its constituent part. The access of risk governmentality states that energy threats or risks can become a specific way of govern-

ance, even manipulation characteristic of neoliberal societies where energy threats and risks are calculated and designed statistically. Energy threats and risks can be treated as a specific way of shaping and controlling the opinions of inhabitants steering the society behaviour in certain direction. It becomes especially relevant when the society is not sufficiently informed.

Usually threats and risks calculated for energy sector are related with potential population group choices, therefore, when presenting specific suggestions it is possible to indirectly force them to make different decisions (e.g. renovation of blocks of flats). Governance is considering more and more the rationality of interest groups, but it is hard to use it if the inhabitants think that energy policy makers do not represent the interests of society. Energy policy makers need to have a certain credit of society trust, but the poll data show that the trust in their representation of public interests is exceptionally low (see Fig.4).

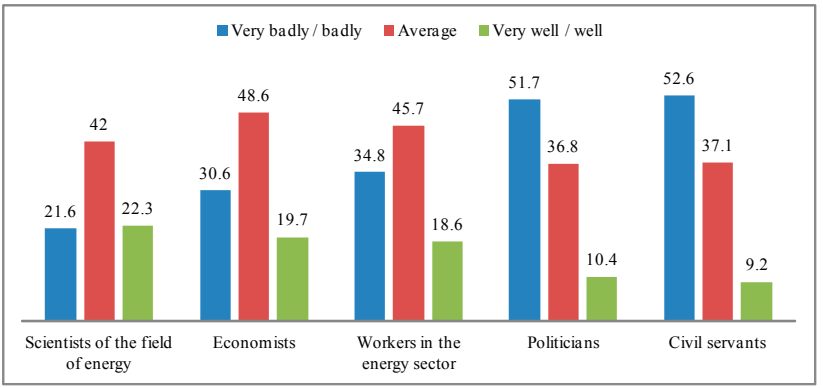

Figure 4. The opinion of Lithuanian inhabitants about the opportunities of public representatives/ civil servants/ specialists to solve energy problems effectively and competently: the assessment of public interest representation

The concern of certain population groups (possible security problems in the Visaginas nuclear power plant or ecological issues of shale gas extraction) can be used in governmentality technologies by offering different opportunities and stressing the welfare for individuals if they use these opportunities. A major part of society does not agree that Visaginas nuclear power plant is safe or does not have the necessary information (Figure 5).

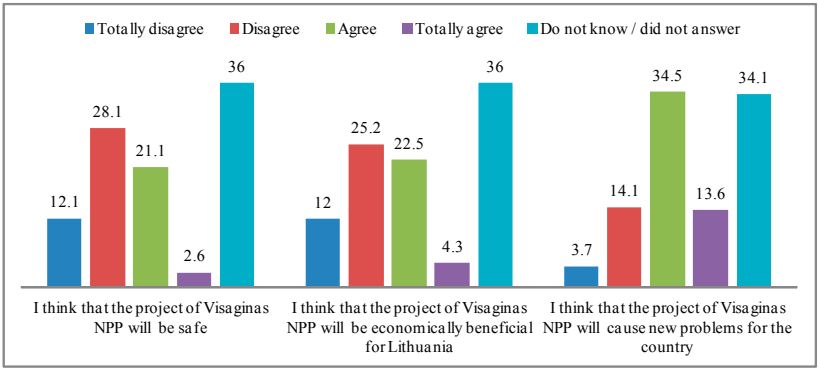

Figure 5. The public opinion about the Visaginas nuclear power plant

From the point of view of governmentality theory, energy risk is designed; therefore, it becomes the constituent part of the governing of the state inhabitants. It can also become the tool for political groups in opposition or foreign countries in the formation of one or another attitude of the society. This risk manipulation is exceptionally prominent in the context of the referendum on Visaginas nuclear power plant project.

It can be stated that the present day public discourse is exceptionally unfavourable for the implementation of energy policy. The inhabitants of Lithuania lay major responsibility for problems in the energy sector on the government (83.7 %) and on Seimas (79.6 %), but, in comparison with energy specialists, researchers and even the

administrators of the energy sector, the opportunities of politicians and civil servants to effectively and competently solve energy problems received the worst assessment. The opportunities of politicians and civil servants to effectively and competently solve energy problems were evaluated as bad and very bad – politicians – 47.1 % and civil servants – 47.9 %.

More than a half of Lithuanian inhabitants assess the politicians' and civil servants competence, productivity and representation of public interest when solving energy problems as bad and very bad; the transparency of politicians' (58.1 %) and civil servants (58.3 %) decisions received exceptionally bad assessment. It can be stated that the energy policy executed by the state faces highly unfavourable public discourse. It is obvious that one of the main reasons for unfavourable public discourse in connection to national energy policy is lack of positive information about energy policy and constructive presentation of the information in the media.

3. PROBABILISTIC AND ECONOMIC ASSESSMENT OF LITHUANIAN ENERGY SECURITY LEVEL

The assessing the security level in time and attempting to predict the dynamics of energy security level, it is necessary to have an economic-optimization model of energy systems. Five energy sector development scenarios were analysed when researching the level of energy security in Lithuania. The basic scenario lasting up to 2017 was considered the main. It included the most important development projects in the Lithuanian energy sector (the liquefied natural gas (LNG) terminal, electricity connections with Sweden "NordBalt" and Poland "LitPol Link" and the development of renewable energy sources), but no more projects are developing. It is in further plans to gradually (up to 2025) close the old units of the Lithuanian power plant (LPP). Other development scenarios focus on renewable energy source power plants, cogeneration power plants and the newly constructed units of the combined cycle. The scenario on construction of new nuclear power plant was also analysed.

The first scenario (SC1) coincides with the basic scenario but the biggest part of electricity is imported. The imported part especially increases when the old units of Lithuanian power plant are closed. As no new activities are taken up and the development of the energy sector is the same as in the basic scenario, import dominates when satisfying the need for electricity.

In the second scenario (SC2), the assumptions are the same as in the basic scenario up to 2023 until a new nuclear power plant (NPP) starts to operate. The NPP investment and unit capacity share considered only for Lithuania (47.5 % of the market, capacity – 657 MW) are analysed in this scenario.

In the third scenario (SC3), the capacities of renewable energy sources are rapidly increasing from 2018 and by 2025 achieve a twice

higher level than it was predicted. Renewable energy sources are subsidised up to 2025.

In the fourth scenario (SC4), up to 2018 all assumptions remain the same as in the basic scenario, but is signified by the fact that beginning with 2018 the old units (5 and 6) of Lithuanian power plant are shut down and replaced by a new 450 MW capacity combined cycle unit. Beginning with 2025 the last old units (7 and 8) of the Lithuanian power plant are replaced by the second new combined cycle unit of the same capacity as the one from 2018.

The fifth scenario (SC5) is a combination of the second and fourth scenarios – starting with 2018 the old LPP units (5 and 6) are replaced by a new combined cycle unit of 450 MW and starting with 2023 a new nuclear power plant is built. Only the part of the unit that is proportionally falling to Lithuania is analysed. This scenario was chosen because the construction of nuclear power plant could be implemented not earlier than 2024 or 2025. In order to maintain the level of energy security and not to allow its decline additional investments would be necessary into a new development project until the NPP appears. With the liquefied natural gas terminal starting with 2015 it would be logical to build a gas-fired combined cycle unit according to this scenario.

Figure 6 demonstrates the projections of Lithuanian energy security level dynamics having applied the discussed methodology for the defined development scenarios.

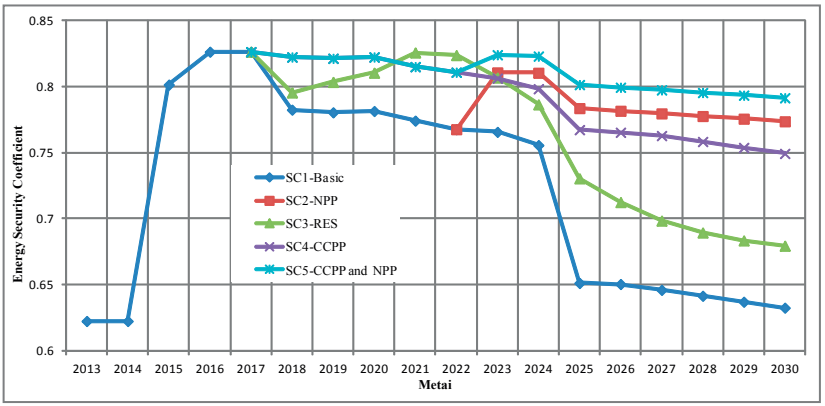

Figure 6. The variation of energy security coefficient in time in the analysed scenarios of Lithuanian energy sector development

The received results show that in 2013 the Lithuanian energy security coefficient was 0.62 (in the scale from 0 to 1). Implementation of already planned and under development projects, in 2016-2017 energy security coefficient would reach the value of 0.83 that would be at the peak in the period 2013-2030. LNG terminal would have a significant influence on this situation offering a natural gas supply alternative for the import from Russia. For this reason, it is likely that the price of natural gas would decrease. In 2016-2017, the Lithuanian electricity system would have a sufficient amount of installed capacities that would be even superfluous for electricity production. It would also help to develop strong connections with electricity systems of neighbouring countries. Still the net cost of electricity produced by the majority power plants in the country would be too high at present and in the future to be able to compete with the price of imported electricity. When the first "LitPol Link" link and "NordBalt" electricity connections start to operate, the opportunities for electricity import would increase and electric energy would be available at more favourable prices. The implementation of the main development projects and the subsequent re-

duction of investments into energy sector would cause energy security to decrease gradually. It has to be noted that up to 2018 the energy sector would develop identically in all the analysed scenarios, and starting with 2018 the level of energy security would start to differ subject to the specificities of each scenario.

The Lithuanian energy sector development scenarios based on the dominant electricity import (SC1) or only on the renewable energy sources (SC3) would ensure lower energy security in the long-term perspective in comparison with alternative scenarios according to which basic electricity generation is implemented in the newly built units of combined cycle or in the new NPP. Though energy security according to three scenarios (SC2, SC4 and SC5) achieved by 2030 is almost the same, the SC5 scenario ensures the most stable security. 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 LNGT and a new NPP ensuring basic electricity generation.

4. THE LEVEL OF LITHUANIAN ENERGY SECURITY IN 2007–2012

The integral energy security level of the country can only be assessed with regard to all factors influencing energy security. There are more than 60 factors or 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 starts from 2007 when the Lithuanian energy security level reached 52.8 % in comparison to the maximum – 100 %. Over the past years the highest security level was achieved in 2008 – 54.1 % and the lowest was noted in 2010 and 2012 – 51.2 %.

In 2010, the situation in the energy sector changed due to closing of Ignalina NPP, because the prevailing resource of electricity 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 reduces energy security.

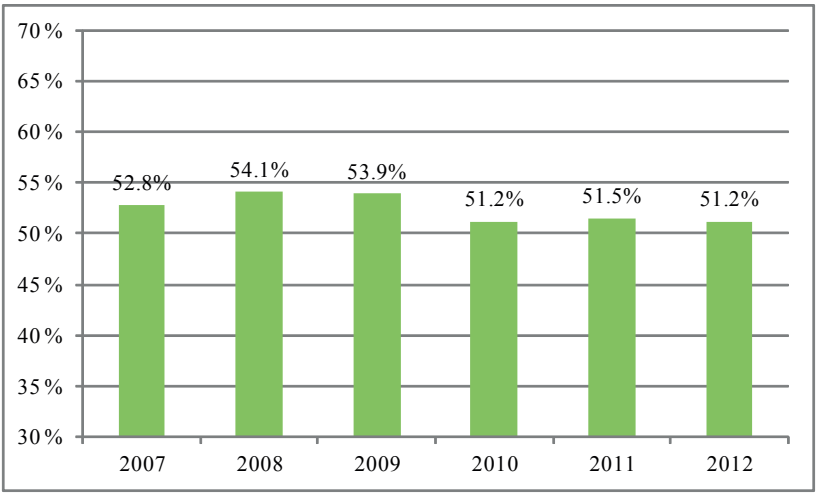

Figure 7. The energy security level in 2007–2012

When assessing the overall energy security level, all indicator results are added up; therefore, the worse situation in one energy security sector is partially compensated by better results from another. 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, connected with nuclear power generation and fuel supply are not included, because at the end of 2009 Ignalina NPP was shut downed.

Since 2008 a major part of indicators fall into pre-critical state and less than one third – into normal state. Such distribution of indicators shows a significant negative influence to the overall energy security level.

Table 1. Distribution of indicators according to states

Year	2007	2008	2009	2010	2011	2012
Critical state	23	22	22	19	18	19
Pre-critical state	22	24	25	22	22	23
Normal state	23	22	21	19	20	18

Most of the indicators falling under the category of critical state are connected with the gas system: the ratio of gas purchase price with the average purchase price in the EU countries, the amount of gas imported from the biggest supplier, high electricity and heat energy production dependency on 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 to 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 block in 2007-2012 changed from 61.5 % to 60.9 %. Technical area is the strongest part of Lithuanian energy sector. High and often superfluous 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 age of energy production equipment 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.

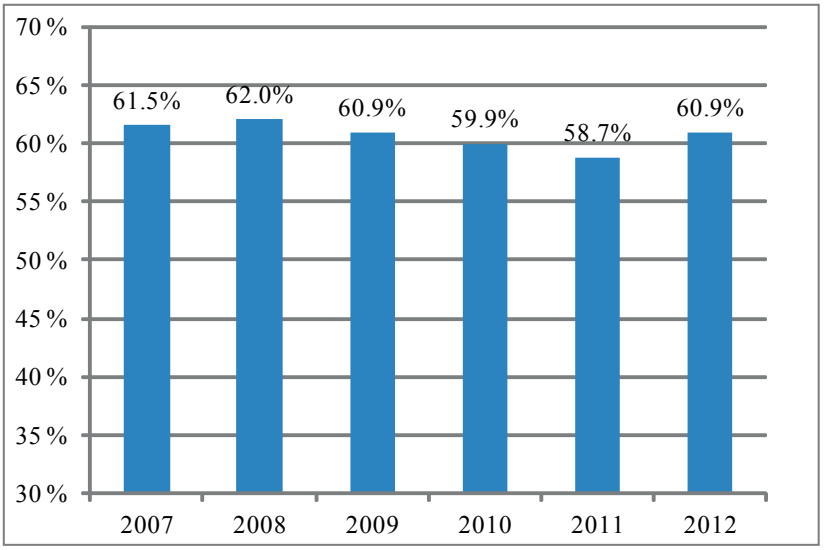

Figure 8. The energy security level of the technical block in 2007–2012

4.3. The energy security level of the economic block

In the period under analysis, the energy security level of economic block increased by 4.6 % and in 2012 it reached 45.8 %. Still, the security level of this block of indicators is the lowest of all indicator blocks. The main indicators of the economic block signifying the critical state 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 Figure 9.

The overall increase of the security level of the block is connected with the development of free markets in the energy sector, first of all in the electricity system. A very large part of electricity import has reduced the overall level of the block since 2010, but Lithuania joining "Balt Pool" market, the growing use of biofuel and the formation of the biofuel market compensate the decrease and create the potential for the rise of the overall block security level.

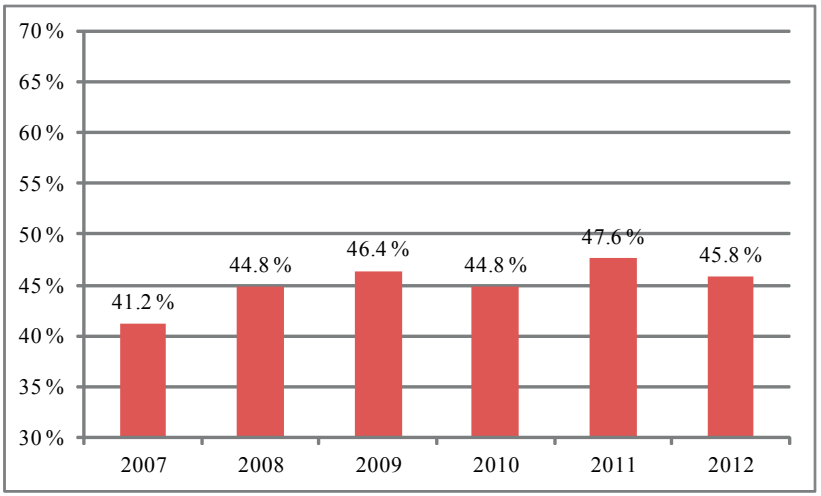

Figure 9. The energy security level of the economic block in 2007–2012

4.4. The level of the sociopolitical block energy security

Lithuanian energy security level in this block in the period of 2007-2012 was signified by obvious decreasing tendencies. The overall security level of the block in 2007 was 55.6 % and in 2012 – only 47.0 %; the security level decreased by 8.6 % and almost equalled the security level of the economic block. 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 Figure 10.

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 for covering heating and electricity. The overall security level of the block was slightly increased by the obligations for energy saving, but this indicator also showed the critical state.

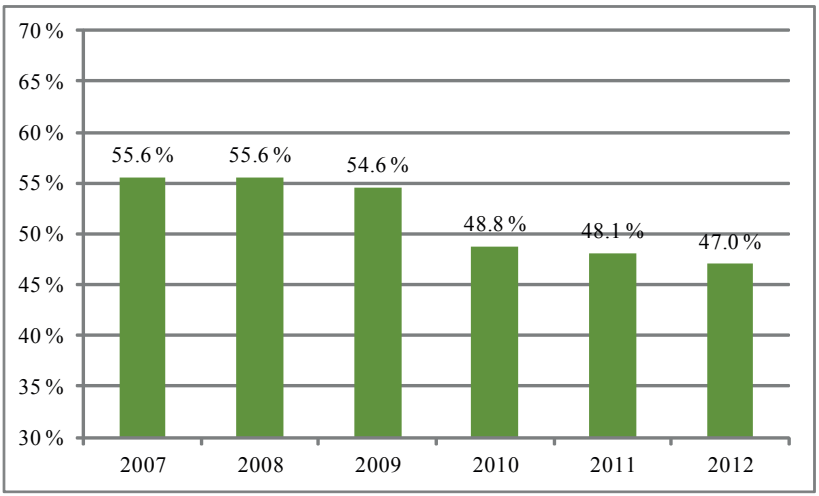

Figure 10. The energy security level of the sociopolitical block in 2007–2012

5. THE COMPARISON OF THE LITHUANIAN ENERGY SECURITY LEVEL WITH THE ENERGY SECURITY LEVEL OF LATVIA AND ESTONIA

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 2. These results show that the energy security level in Latvia and Estonia are higher than in Lithuania. The security level in Estonia falls under the normal state and in Latvia is close to the normal state.

Table 2. The dynamics of energy security level

Year	2008	2009	2010	2011	2012
Lithuania	54.1 %	53.9 %	51.2 %	51.5 %	51.2 %
Latvia	62.0 %	62.3 %	59.2 %	60.1 %	61.5 %
Estonia	63.4 %	64.4 %	62.2 %	65.0 %	66.2 %

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 state in the economic block are mostly those connected with the gas sector. A similar situation exists in Latvia and Estonia. Still, the assessment of the energy security level of the three Baltic States there emerge differences 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 32 %, in Latvia it amounts to 16 %, in Estonia – 7 %. The biofuel sector receives the best assessment in all three states. In Lithuania it makes up about 20 %, in Estonia – about 23 % and in Latvia – almost 39 % depending on the energy security level (Table 3).

Table 3. Average group values in the technical and economic blocks of the Baltic States

	Lithuania	Latvia	Estonia
Electricity	18.52 %	20.96 %	35.53 %
Gas	32.11 %	16.40 %	7.22 %
Oil	4.49 %	0.22 %	0.53 %
Coal	3.50 %	3.37 %	5.22 %
Biofuel	20.62 %	38.72 %	23.10%
Heating	20.76 %	20.33 %	28.40 %

The energy security level in Latvia is increased by two reconstructed blocks of Riga combined heat and power plant and Inčukalns underground gas storage. Estonia is the exporter of electricity and electricity is produced by using own resources. These factors are exceptionally favourable for the Estonian energy security.

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