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Prospects for the Development of Nuclear Energy in the Baltic Region

The article aims to evaluate the prospects of construction of a nuclear power plant in Lithuania and the possible benefits, as well as to analyse the decisive factors of development of nuclear energy in Europe and worldwide. Attention is paid to the increasingly stringent regulation of the development of nuclear energy, which may play a role in the growing competition among the nuclear power plants built in Lithuania, Russia and Belarus. The article ends with the conclusion that despite the high costs of construction of nuclear power plants, pending problems of disposal of spent nuclear fuel, rapid development of renewable resources and other factors, nuclear energy will retain its role in the energy balances of the countries in the region. The article also gives a positive assessment of the possibilities of construction of a nuclear power plant in Lithuania.

Introduction

In 2011, 441 nuclear reactors were in operation around the world. Among them, 104 nuclear reactors were running in the US (10 more reactors are scheduled to be built), 58 (2) in France, 55 (14) in Japan, 21 (11) in South Korea, 19 (4) in the UK, 18 (5) in Canada, 6 (2) in the Czech Republic. The largest share of nuclear energy was also generated by nuclear power plants in the West, for instance, the electricity produced by nuclear power plants amounted to as much as 75% of the total energy produced in France, 53% in Slovakia, 51% in

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Belgium. In the meantime, as many as 2.4 billion people faced a shortage of electric power supply and 1.4 billion people lacked any access to electricity in the remaining part of the world. According to UN Secretary-General Ban Ki-moon, to achieve the Millennium Development Goals, all energy generation technologies, including nuclear power, will have to contribute to the supply of those people with electricity¹. The development of nuclear power is also driven by another important factor. The phase-out of nuclear power in the West alone would boost the demand for natural gas by over 400 billion cubic meters by 2045. Therefore, nuclear energy is a tool to the partial reduction of dependence on exhaustible conventional energy sources.

In the context of strengthening energy security, the EU institutions finance the development of cross-border electricity and gas links, and develop a formal and informal dialogue with the existing and potential EU partners in the areas of extraction and transportation of energy resources. Furthermore, the Member States invest in specific plants, including nuclear power plants. It is projected to build at least four nuclear power plants (NPP) in the Baltic Sea region in the ten upcoming years, one of them in Lithuania. It should be noted that not only energy systems but also all prospects of economic development in the country are associated with the development of nuclear energy: strategic documents maintain that it is exactly the new NPP that will determine the assurance of sufficient local capacities to meet the demand of the local electricity market. However, it will not be easy to build a NPP in Lithuania – as a result of the plans of construction of equivalent objects in the neighbourhood (in Kaliningrad, Belarus, Poland), as well as the deteriorating Lithuanian political relations with the countries participating in the project, economic and financial instability in Europe, sufficient momentum in the expansion of alternative energy generation capacities and other objective circumstances.

When analysing the decisive factors in the development of nuclear energy, it should be noted that the approach of the global community, the EU institutions and its Member States, including the states of the Baltic Sea region, towards the development of nuclear power is neither unanimous nor stable. In other words, it is under ongoing evolution – agreements and commitments are continuously replaced by new, more relevant decisions in line with the changes in the situation. Due to the changes in the situation, the agreements concluded more than five years ago fall into oblivion – therefore, the present study focuses on the discussion on the most relevant tendencies and agreements. With the EU, the International

¹ United Nations High-Level Meeting on Nuclear Safety and Security convened by the Secretary-General, 22 September 2011.

Atomic Energy Agency (IAEA), other international institutions recognising that the development of nuclear energy is a matter for the countries to decide for themselves, the article focuses on the progress and motives of the countries in the region determined to develop this type of energy, as well as the impact of external factors on realizing the plans. It is driven by two goals: to give an objective evaluation of the prospects of construction of a new NPP in Lithuania and its impact on Lithuania's energy security.

The article essentially supports the public opinion expressed on several occasions that one or two export-oriented nuclear power plants will have the potential to function in the region successfully. Considering that Lithuania will also seek to export the energy generated in the Visaginas Nuclear Power Plant (VNPP), we must inevitably compare the project supported by Lithuania with the progress made in the implementation of equivalent projects in the neighbouring Kaliningrad, also Belarus, and Poland. Whereas the VNPP project is a cross-border project, it is necessary to analyse the energy interests of both Lithuania and other countries of the Baltic Sea region when making an evaluation of its prospects. The construction and operation of the power plant will definitely have an effect on the energy and economic security of the countries participating in the project, as well as the bilateral relations of the project partners – the second and the third sections of the article are dedicated to the discussion of these aspects.

The evaluation of the impact of a new NPP on the energy security of the country and the region, financial and economic nuclear safety and other aspects of construction of the NPP in Lithuania mostly relied on the national and EU legal acts, also non-classified information on the construction of nuclear power plants. The insights of Lithuanian scientists (both opposing to, and supporting the implementation of the VNPP project) on financial, legal and political aspects of NPP construction, the NPP impact on environment and the energy security of the Baltic States proved to be particularly useful. However, the study also paid significant attention to the legal regulation of construction of nuclear power plants, i.e. the analysis of the requirements and recommendations enshrined in the documentation of Lithuania, the EU and other international organisations.

1. Legislative Framework of Nuclear Energy Development

The Treaty establishing the European Atomic Energy Community (Euratom) signed in 1957, which declares the support of the European Communities to the development of nuclear energy, is still in force in the EU. It would be reasonable to believe that the present differences of opinion among the EU Member States on the development of nuclear energy can be harmonised in accordance with said treaty, through discussions on the modification of the treaty, etc. This seems all the more so since the afore-mentioned treaty imposes serious obligations on the Member States; for instance, Article 37 requires that each Member State is to provide the Commission with general data relating to any plan for the disposal of radioactive waste. However, in the absence of clear mechanisms on the performance and control of obligations in the treaty and with the Member States themselves seeing Euratom as a more technical rather than political instrument, today, the most considerable attention is paid to the creation of a new legislative framework regulating nuclear energy. The article continues with a review of the most current and relevant national, EU and international legal acts regulating the development of nuclear energy.

1.1. National Legal Acts, Decisions Relevant to the VNPP Project, Commitments and Recommendations

The construction of a new NPP in Lithuania is regulated by the Law on the Nuclear Power Plant adopted in 2007, the resolutions of the Government specifying it, as well as the orders of the minister of economy and the minister of environment, environmental impact assessment reports and other documents. Among the most important instruments in this field (not to mention the plans, studies and strategies of construction-site evaluation, territorial planning, transportation, radioactive waste management, business model and financing, etc. prepared at the initiative of the VNPP) are Resolution No 300 of 22 April 2009 adopted by the Government of the Republic of Lithuania “On the Approval of the Strategic Directions of the Implementation of the New Nuclear Power Plant Project in Lithuania”, Resolution No 1143 of 9 September 2009 of the Government of the Republic of Lithuania “On the Setting-up of the Commission for the Supervision of Implementation of the Project of the New Nuclear Power Plant in Lithuania” and Resolution “On Draft Law No XIP-385 Repealing the Law on the Nuclear

Power Plant of the Republic of Lithuania”, as well as Resolution No 726 of 11 July 2007 “On the Implementation of the Law on the Nuclear Power Plant of the Republic of Lithuania”, and Order No 4-142 of 9 April 2008 of the Minister of Economy of the Republic of Lithuania “On the Preparation of the Special Plan for Construction of the New Nuclear Power Plant in Utena County”.

All of the aforementioned documents essentially support the construction of the VNPP; all the legal, financial and organisational preconditions for implementing the project are met. Furthermore, it should be noted that all the said legal acts were adopted implementing the National Energy Strategy approved by the Seimas on 18 January 2007, which sets out the national goals of energy development in direct association with the nuclear energy in Lithuania²: 1) development of primary energy sources in restoring nuclear energy; 2) ensuring of continuity, succession and development of safe nuclear energy. Apart from other things, this strategy refers to the new NPP as one of the measures which are expected to increase Lithuania’s energy security and to tackle the problem of climate change.

The new National Energy (Energy Independence) Strategy (drawn up by the Government and still pending the approval of the Seimas in 2011) stipulates that the implementation of all long-term national goals in energy sphere rests on the construction of the new NPP. This document refers to the development of nuclear energy as a prerequisite for the country’s energy independence. Hence, the legislative framework currently applicable in Lithuania refers to the construction of the new NPP in the country as the key strategic goal in pursuance of the country’s energy independence, balance of production and consumption of electricity, efficient use of the existing energy system and the experience of operation of nuclear technologies.

1.2. EU Regulation

The EU treats nuclear energy as an important part of a balanced energy structure contributing to the objectives of the EU in reducing the carbon dioxide emissions and attaining other goals of the EU energy policy by 2020 and by 2050. These preconditions are also reflected in the medium-term scenarios of energy consumption.

² National Energy Strategy approved by Resolution No X-1046 of 18 January 2007 of the Seimas of the Republic of Lithuania

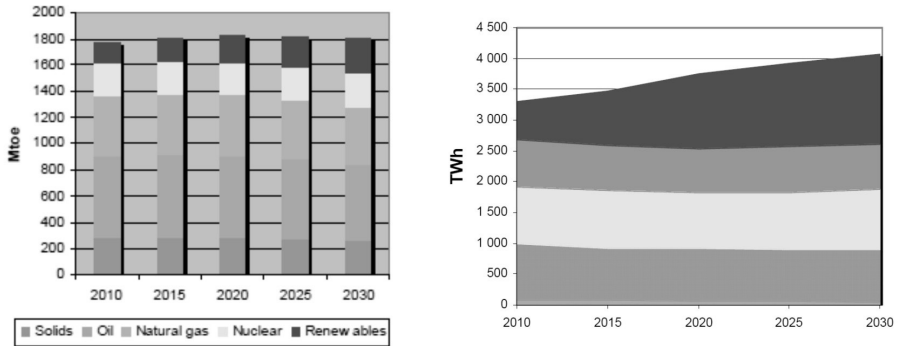


Figure 1. Primary energy consumption by fuel in the EU (Mtoe)³

However, according to the case-law of the European Court of Justice, nuclear safety falls within the shared competence of the EU and the Member States⁴. This means that the Member States have a right and obligation to adopt mandatory legislation in the areas regulated by the Convention on Nuclear Safety (adopted in 1994). The EU has the priority in setting the general principles of legal regulation but it is up to the Member States themselves to decide on how to incorporate the decisions taken at the EU level to the national law, what national policy measures to apply and how to implement the minimum requirements set by the EU, taking into account the specific characteristics of the national energy policy and law-making.

As far as the EU responsibility limits are concerned, it is worth mentioning the Council Directive of 25 June 2009, which establishes a Community framework for the nuclear safety of nuclear installations⁵. The Nuclear Safety Directive also sets out other EU objectives in this area: 1) an obligation to establish and maintain a national legislative, regulatory and organisational framework for nuclear safety of nuclear installations; 2) an obligation to establish and maintain a competent regulatory authority in the field of nuclear safety of nuclear installations; 3) the general principle according to which the prime responsibility for nuclear safety of a nuclear installation rests with the licence holder, i.e. an organisation operating a nuclear installation; 4) an obligation to maintain and to further develop expertise

³ COM(2010) 677, 17.11.2010. (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions – Energy infrastructure priorities for 2020 and beyond – A blueprint for an integrated European energy network), p. 21-23.

⁴ Cases of the European Court of Justice: *Land de Sarre and others v Ministre de l'industrie* (C-187/87), *Commission v Belgium* (C-376/90), *Commission v Council* (C-29/99).

⁵ Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations.

and skills in nuclear safety; and, 5) an obligation to ensure that information in relation to the regulation of nuclear safety is made available to the general public.

Even though the EU institutions have not yet developed a legal framework prescribing the Member States what energy resources to use, what to produce or from where to import, the European structures (which, by the way, also refer to the Euratom Treaty) express their strong support to the research targeted at safety and technological development. Furthermore, among the four priorities for the general European energy policy enshrined in the Lisbon Treaty (creating an internal market; guaranteeing security of supply; promoting the use of renewable energy; and promoting efficient use), the first two also apply to the development of nuclear energy. In fact, at this point we face a dilemma – how to combine the plans of the EU infrastructure development and the establishment of a single market with rather diverging visions of the Member States as regards the values of traditional and alternative resources in their energy balances and with the decisions adopted at the national level as to the construction or decommissioning of nuclear power plants, conclusion of long-term agreements with resource suppliers, etc.

It is worth remembering that in the Euratom Treaty, the Member States resolved “to create the conditions necessary for the development of a powerful nuclear industry”. Relatively recently, in 2007, the European Nuclear Safety Regulators Group was established at the initiative of the EU, and in 2009 the Council adopted a directive on nuclear safety. At the first Special Energy Summit in February 2011, the European Council drew the Conclusions calling to uphold the highest standards for nuclear safety at the international level. It should be added that the expansion of nuclear energy in the EU is considered one of the measures helping to cope with climate change⁶. It can also be proven by the Council Conclusions of 4 February 2011⁷ recognising nuclear energy as a low-carbon energy technology along with renewable energy sources.

However, the EU is increasingly focusing on tightening nuclear safety requirements within the EU and beyond its borders at the initiative of the opponents to the development of nuclear energy (Ireland, Austria, Greece, Lichtenstein,

⁶ The EU Member States resolved to reduce the greenhouse gas emissions by an average of 20% (compared to 1990 levels); to increase the share of renewable energy sources in the final energy consumption to 20%; and to achieve a 20% increase in energy efficiency by 2020. COM(2010) 2020 final, Brussels 3 3 2010. (Communication from the Commission Europe 2020 a Strategy for Smart, Sustainable and Inclusive Growth).

⁷ European Council 4 February 2011 Conclusions.

Luxembourg, Malta and Portugal can be attributed to this group⁸)⁹. On 25 March 2011, the Heads of States and Governments of the EU Member States concluded that the safety of all EU nuclear power plants should be reviewed on the basis of the so called ‘stress tests’. On 25 May 2011, the European Commission and the European Nuclear Safety Regulators Group (ENSREG) agreed on the scope and modalities for comprehensive risk and safety assessments of EU nuclear power plants¹⁰. In accordance with the applicable requirements, the tests of resistance to the most unfavourable operational states (natural disasters, aircraft crashes, terrorist attacks, etc.) of 143 nuclear power plants operating in the EU based on a set of common criteria started on 1 June 2011. We may say that with this initiative the EU has taken an essential step towards a broader competence in shaping the nuclear energy policy of the Member States. However, it is yet too early to assert that the EU has taken the initiative in the area of construction of nuclear power plants – the national regulatory bodies of nuclear safety carry out the same ‘stress tests’ in the EU Member States.

1.3. IAEA and Espoo Mechanisms

After the Fukushima nuclear accident, United Nations (UN) Secretary-General Ban Ki-moon highlighted the need to strengthen the safety of nuclear power plants by establishing strong international safety standards. If the proposal was realized, it would also mean the strengthening of the capacity of the relevant international organisations – particularly the UN International Atomic Energy Agency (IAEA)¹¹. However, Yukiya Amano, IAEA Director General, believes that it is only possible if governments, regulators and plant operators work together with the IAEA¹². Nevertheless, the IAEA has already showed its capacity in proposing certain specific initiatives, for instance, the Action Plan on Nuclear Safety. The 12-point action plan includes the recommendations to the countries¹³: strengthen emergency preparedness and response; strengthen the ef-

⁸ *Ministerial Declaration 2011-05-25; Finale Fassung*, http://nonuclear.se/files/vienna_declaration20110525.pdf, 18.10.2011.

⁹ This tendency does not only reveal in the public commentaries and statements of the Heads of the EU Member States on this issue but also in the commitment of the European Commission to allocate an extra 110 million euro donation for the construction of a new sarcophagus over the exploded Chernobyl nuclear reactor.

¹⁰ Declaration of ENSREG - EU “Stress Tests” Specifications, 25.05.2011.

¹¹ *Fukushima accident a ‘wake-up call’ to boost nuclear safety, UN forum told*, <http://www.un.org/apps/news/story.asp?NewsID=39684>, 15.10.2011.

¹² *Fukushima accident a ‘wake-up call’ to boost nuclear safety, UN forum told*, <http://www.un.org/apps/news/story.asp?NewsID=39684>, 15.10.2011.

¹³ *Draft IAEA Action Plan on Nuclear Safety*, <http://www.iaea.org/About/Policy/GC/GC55/Documents/gc55-14.pdf>, 25.09.2011.

fectiveness of national regulatory bodies; ensure the ongoing protection of people and the environment from ionizing radiation following a nuclear emergency; enhance transparency and effectiveness of communication; effectively utilize research and development, etc. However, at this point the organisation limits with recommendations and does not interfere with cross-border or domestic disputes in relation to the construction of NPP.

The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo) is yet another instrument targeted at the strengthening and implementation of nuclear safety requirements. In the framework of this Convention, the neighbouring countries undertake to inform on the planned construction of the objects which may have any potential adverse environmental impact and to involve the neighbouring countries in the environmental impact assessment (EIA) processes. The list of activities regulated by the Espoo Convention covers the nuclear power stations and other nuclear reactors, including installations designed for production or enrichment of nuclear fuel, also installations for the reprocessing of irradiated nuclear fuel or for the disposal of irradiated nuclear fuel. In other words, the provisions of the Espoo Convention regulating the environmental impact assessment procedures of the projected activity apply in respect of the aforementioned installations.

According to the agreements under the Espoo Convention, the final decisions on the projected NPP must be taken and the actual works must be commenced upon the evaluation of the environmental impact assessment results only, including the commentaries of the countries participating in the process and the conclusions of consulting with the said countries. It should be noted that the EIA procedures do not only seek to answer whether to allow the construction of a NPP or not but also to identify the alternatives for construction of a NPP and the possible measures for mitigating the environmental impact to make sure that the impact would not exceed the permissible limits, etc. The applicable national legislation, as well as normative and territorial planning documentation must answer a question whether the projected activity is essentially possible. If the projected activity is in breach of the laws or official normative documentation, the EIA procedures shall not be initiated at all. However, it can be concluded that, like in the case of the IAEA, the agreements binding in the framework of the Espoo Convention cannot be considered a decisive factor in accelerating or preventing from the construction of a specific power plant.

2. Development of Nuclear Energy in the Region: What Constructions are Projected and Where?

According to the current projects, four nuclear power plants in total are being planned for construction in Lithuania, Poland, Belarus and the Kaliningrad Region at a similar time; the construction of another nuclear power plant is already in progress in Finland. With the progress of development of nuclear power plant projects, the growing energy demand, the increasingly stringent environmental standards regulating CO₂ emissions and too little attention to alternative energy projects in mind, we may have no doubts that at least one nuclear power plant will definitely be constructed in the region in the upcoming ten years. Yet another question is: which one and what will happen to the remaining projects?

2.1. Projects of Construction of Nuclear Power Plants and Their Prospects

This sub-section gives a short review of all projects of construction of nuclear power plants discussed in the public domain and in progress of construction, as well as the prospects of their implementation.

2.1.1. Visaginas Nuclear Power Plant and Its Prospects

The Japanese company Hitachi Ltd. together with Hitachi-GE Nuclear Energy Ltd. were selected as the strategic investor for the VNPP. According to the Ministry of Energy of the Republic of Lithuania, by proposing a 1300 MW capacity advanced boiling water reactor (ABWR), the company made the most acceptable proposal in economic, legal and technical terms¹⁴. The nuclear power plant is expected to be built by 2020; it should supply electricity to the Baltic States and Poland; export opportunities to the directions of the East, the West and the North are under consideration. In the VNPP project, Lithuania should hold the largest portion of shares, i.e. no less than 34% of the shares; a part of shares will most likely go to the Japanese company, as well as Estonia and Latvia, who have participated in the negotiating procedure with them since the initial stage, and

¹⁴Compared to other technologies, ABWR-type reactor is asserted to consume less nuclear fuel and stands out for its higher level of nuclear fuel combustion and longer estimated useful life. Four reactors of this type already operate in Japan, two more are under construction, other two reactors are in progress of construction in Taiwan.

possibly Poland. In line with the requirements of Article 41 of the EURATOM Treaty, the notification of the VNPP project was officially submitted to the European Commission. The American electricity infrastructure company Exelon joined the VNPP project in the middle of 2011 as a project engineer. Once the key principles of the Concession Agreement were coordinated in the second half-year of 2011, on 23 December Chairman of the Concession Tender Commission and Vice-Minister of Energy Žygimantas Vaičiūnas and Vice-President of the strategic investor Hitachi Masaharu Hanyu signed an agreement on the content of the Concession Agreement and the determination of the integral parts thereof.

However, the end of 2011 gradually showed that Lithuania's regional partners in the VNPP project were driven by rather different goals in comparison to Lithuania's. In the early December, the Polish energy company PGE announced its decision to freeze its participation in the project. The company's decision can be seen as a tactical step (perhaps even without coordination with the government) in negotiating the long-standing requirement to dedicate at least 1000 MW of the energy capacities of the new NPP for Polish needs. However, the plans of PGE and the Polish government to construct several nuclear reactors on the territory of Poland with reference to the EU requirements on the reduction of carbon dioxide emissions as well as the deteriorated political relations between Warsaw and Vilnius must not be forgotten as well. The worst part is that Poland's final withdrawal from the project may reduce PGE's motivation to complete the construction of the Lithuanian-Polish interconnection LitPol Link – it is a decisive project in the endeavour of the Baltic States to connect to ENTSO-E's synchronous grid of Continental Europe for synchronous operation¹⁵. Latvia also asked Lithuania some additional questions by declaring that it was not convinced of the benefit of integration to the synchronous grid of Continental Europe (ENTSO-E). With these circumstances in mind, even if the VNPP project was realized, there is a chance that it would not guarantee energy independence in electricity sector for Lithuania. As a result, questions would be brought forward as to the purpose of implementation of the project itself.

2.1.2. Baltic Nuclear Power Plant

The construction of the Baltic Nuclear Power Plant (BNPP) in Kaliningrad Region (near the town of Neman) is being carried out by the Russian company Rosatom. Yet another Russian energy giant – InterRao JES – is responsible for

¹⁵ ENTSO-E (*European Network of Transmission System Operators for Electricity*) system connects 42 operators of transmission systems across 34 countries

the project's financial schemes and negotiations with potential foreign investors. Two VVER 1200/491 type reactors of 1200 MW capacity each supplied by the Russian company Atomstroyexport will be constructed¹⁶. It is projected that the first reactor will be launched in 2016 and the second will be put into operation in 2018 (two more reactors can be constructed in Kaliningrad by 2025). It was planned to obtain the licences for the construction of the two reactors by the end of 2011, and the contracts for construction works are expected to be prepared by 2013. An important further note: the key political decisions on the construction of the reactors were taken as far back as 2008-2009¹⁷; the preparations of the site for the power plant began in 2010. With Rosatom planning to sell up to 49% of the shares of the Kaliningrad Nuclear Power Plant, investors from Austria, Czech Republic, Spain, Italy, France and Germany¹⁸ are mentioned. According to official 2011 estimates, the nuclear power plant in Kaliningrad should cost 6 billion euro. The power plant is expected to supply the consumers of Kaliningrad Region with electricity (to ensure a reliable electricity supply to local consumers independently from the Baltic countries after they become a part of the ENTSO-E network), to reduce the consumption of natural gas for the production of electricity and to ensure conditions for the export of electricity to the neighbouring countries.

The chances that the power plant in Kaliningrad will be constructed are particularly high. It is determined by one major circumstance: Moscow takes advantage of nuclear energy (like oil and gas) in pursuit of political and economic goals in Russia and the neighbouring countries. For instance – to reduce gas consumption in the internal market (thus meeting gas export obligations), to block the construction of a power plant in Lithuania, thus maintaining the dependence of the Baltic countries on the import of gas and electricity from Russia, and to contribute to the compensation of Germany's energy generation deficit determined by the Berlin decision to phase out nuclear energy. A new nuclear power plant in Kaliningrad would help to keep the countries of Western, Central and Eastern Europe "tied" to the Russian energy policy; hence, it can be seen as one of the priority instruments of the Kremlin strategy. These objectives may be realized irrespective of Lithuania's attempts to neutralise them: in 2010 Russia made a proposal of collaboration to Poland in constructing the Baltic NPP, importing electric power and building a link between Kaliningrad and Elbląg, which Russia could use for the export of energy to Poland and Germany.

¹⁶ *Baltic NPP project in the Kaliningrad Region* <http://baltnpp.rosenergoatom.ru/wps/wcm/connect/baltaes/site/resources/905fda0047d5d749ae84bedadfdf304b/baltaesEng1.pdf>, 11.11.2011.

¹⁷ Ibid.

¹⁸ The French bank Société Générale has been selected as the investment consultant; the international company WorleyParsons is a technical consultant, while the company Norton Rose provides legal consultancy services.

Though back then PGE refused to participate in the construction of the BNPP, in 2010 it began the negotiations with Inter RAO on the opportunity to build a link between Poland and Kaliningrad.

However, there is also a chance that the nuclear power plant in Kaliningrad will not be constructed or it will not be exploited in full capacity if constructed. Such a scenario is possible if the BNPP failed to agree on the export of a substantial share of electricity to Western and Northern Europe – it would respectively increase the risk of investment, and could potentially deter foreign investors or slow down the production of electricity and increase its price. The Baltic States (they all are stakeholders in the VNPP project) and Poland (participating in negotiations over the VNPP project and planning the construction of its own nuclear power plant) would support such a sequence of events. It should be noted that the needs of Kaliningrad could be satisfied by exploiting the capacities of a new gas-fired power plant – if it is put into operation, the BNPP will have to export as much as 80% of the generated energy. However, the export of energy to Poland, Germany, and Scandinavia is limited by the lack of physical infrastructure – even though the link projects implemented by Lithuania and Poland would solve a part of the existing difficulties, at least Vilnius could succeed in preventing the use of the infrastructure for the export of electricity generated in an “unsafe” power plant. However, it is yet difficult to tell what the position of the Baltic States, Scandinavia, Poland and Germany (the said countries also have the power to determine the EU policy in terms of the BNPP) will be when the BNPP becomes a reality (Moscow can construct a nuclear power plant without a clear plan of how electricity will be sold)¹⁹. For instance, though officially Lithuania categorically objects to the construction of the BNPP (for the reason of the BNPP “unsafety”), in March 2011 InterRAO Lietuva signed an agreement with InterRAO JES on the opportunity to supply up to 1000 MW of electricity from the BNPP to the Baltic States and the neighbouring countries in 2017–2036.

2.1.3. Astraviec Nuclear Power Plant

The key political decisions relating to the construction of the nuclear power plant in Belarus were adopted in 2007–2008. The construction of the nuclear power plant is the responsibility of the state enterprise Belnpienergoprom; the Russian Atomstroyexport should supply the reactors; the agreement on the imple-

¹⁹ Baltes.ru *The Baltic NPP project meets all current international safety requirements. It combines active (requiring human interference and a power source) and passive (not requiring operator's actions and a power source) safety systems*

<http://baltaes.ru/wps/wcm/connect/baltaes/siteeng/temp/Nuclear+sefety> , 21.11.2011.

mentation of the project was signed with Rosatom. Two reactors are projected to be constructed in Astraviec district: the first should be put into operation in 2017, while the second reactor will be fired up in 2018. According to the Belarusian authorities, the actual reactor construction work will start in spring 2012. The power of both reactors of the NPP is expected to amount to 2400 MW. The power plant will be equipped with new-generation Russian reactors AES-2006. According to the official estimates of 2011, the project value will equal to 9 billion US dollars (the initial estimate placed the value at 5 billion US dollars).

On 15 March 2011, Russia and Belarus signed an intergovernmental agreement on cooperation in the design, construction and operation on the Astraviec Nuclear Power Plant (NPP). Among other points, the agreement stipulates that Russia shall supply and Belarus shall purchase the nuclear fuel required for the NPP throughout the period of operation of the Astraviec NPP. On 11 October the same year, the Russian state enterprise Atomstroyeksport and the Belarusian state enterprise Belnapienergoprom signed a technical agreement on the construction of two reactors of the Astraviec NPP. On 25 November 2011, the Russian Prime Minister Vladimir Putin reported on the achievement of the agreement to lend 10 billion US dollars for the construction of the power plant for a period of fifteen years. According to the Belarusian Deputy Minister of Energy Michail Michadiuk, the amount should suffice to cover some 90% of the NPP construction costs. China promised a loan of other 3 billion dollars for the Astraviec NPP infrastructure works. It was planned to sign the so called “general contract” in the beginning of 2012.

However, despite the apparent progress, several aspects should be taken into consideration when evaluating the chances of construction of the power plant. First of all, Lithuania expresses active opposition to the Astraviec NPP construction plans. Even though according to A. Andrejev, Head of the Public Examination Board under the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus, Belarus completed consulting with all countries (i.e. coordinated environmental impact assessment reports with them), Lithuania does not agree with it and brings up the issue of safety of the Astraviec NPP in international forums²⁰. The Lithuanian requirements are also supported by the Belarusian Greens²¹ accusing the government of non-compliance with the Aarhus Convention as regards the public

²⁰ Belta.by *Минприроды Беларуси ответило на претензии Литвы к строительству и безопасности будущей АЭС* [The Belarusian Ministry of Natural Resources and Environmental Protection replied to Lithuania's claims on the construction of the projected NPP] http://www.belta.by/ru/all_news/politics/Minprirody-Belarusi-otvetilo-na-pretenzii-Litvy-k-stroitelstvu-i-bezopasnosti-buduschej-AES_i_555602.html, 21.05.2011 (in Russian).

²¹ Such movements as *Belarusian Anti-Nuclear Campaign*, *Scientists for a Nuclear-free Belarus*, *Ekodom*, *Ekoklub*, *The Greens* play an active role in Belarus. The residents of Astraviec district founded a regional public initiative *A Nuclear Power Station in Astraviec is a Crime*.

right to participate in environmental decision-making. Though the openly declared doubts on the safety of the Astraviec NPP expressed by Lithuania or the Belarusian NGOs gave no tangible results, the demand to comply with international safety standards may become an actual measure of impact in the future – when Belarus or Russia decide to export the electricity produced in those countries in pursuit of closer cooperation with the EU in other areas.

Generally speaking, the chances of constructing the Astraviec NPP by the expected date (2017–2018) are rather low. Belarus faces continual difficulties in paying for the electricity supplied, while Moscow encounters problems even in financing the construction of its own nuclear power plants (for instance, the construction of the reactor Belojarsk-4 falls behind schedule as a result of the shortage of funding). The manifestly political character is another reason for doubting the success of the Astraviec NPP project – even though the Belarusian government highlights the goals of strengthening energy independence, in reality, the financing of the new NPP, construction, supply of equipment and fuel, as well as waste disposal – everything will depend on the sole country and even on the sole corporation, i.e. Rosatom. Furthermore, the aforementioned intergovernmental Belarusian-Russian treaty on the construction of the Astraviec NPP was signed along with the agreement on the measures ensuring a parallel operation of the unified Russian and Belarusian energy systems. It means that the existing and newly built objects of energy infrastructure will have to operate in coordination of the actions of the two countries – a separate enterprise responsible for the modernisation of networks and the export of Russian and Belarusian energy to the third countries is to be established for that matter. In other words, Russia will have the capacity to control the export of Belarusian energy in the future – if there are any countries ready to import it. Hence, if, upon the change of circumstances, the Belarusian government nevertheless resolved to strengthen the energy independence of the country, the repeal of the agreements on the Astraviec NPP could become one of the first steps.

2.1.4. Is There a Chance to Construct Several NPP in the Baltic Sea Region?

There is a chance that only the Visaginas NPP will be constructed in the region in the upcoming ten years – in this case, despite the higher price compared to importing from Russia (but without the threat of energy blackmail), the Baltic States would satisfy all electricity needs, and could export a part of the electric energy generated in the region through the newly established links with Finland, Sweden and Poland to Western and Northern Europe. However, there is a chance that only the Baltic NPP will be built – in that case, the Baltic States would most

likely stay dependent on the supply of cheaper electricity from Russia or would be forced to consume far more expensive electric power generated by means of alternative, renewable or imported resources. The positive aspect of such a scenario is that the problem of disposal of nuclear waste would be redundant; conditions would be created for the development of alternative resources and the implementation of the programs promoting energy efficiency. In other words, the development of the Baltic energy sector would be more dynamic and flexible. The negative outcomes of such a scenario are that in the event of a failure to implement an ambitious program of development of alternative resources and energy saving goals, the suppliers of energy resources may start making a considerable impact on economic, political and social life of the region. Also, there would be additional problems in connecting to the European ENTSO-E system for synchronous operation.

Nevertheless, there is a strong chance that both nuclear power plants – the Baltic NPP and the Visaginas NPP – will be constructed. Such a result is determined by two circumstances: more progress has already been made in the implementation of the Visaginas NPP, but once the BNPP becomes a political project (supported by the Kremlin in political and financial terms), the power plant is to be put into operation even earlier than the VNPP. If both the VNPP and the BNPP projects were realized, the region may witness the surplus of electric power generation capacities, thus slowing down the development of alternative energy resources. It is very likely that the two power plants would sooner or later start competing between themselves over the establishment of their positions in the electricity market of Western and Northern Europe. If the Visaginas NPP lost this competitive fight (it could happen if the Baltic NPP succeeded in escaping the limitation on export and agreeing with Lithuania and Poland on the transit of electricity across their territory, as well as installing the required infrastructure), to meet the commitments made to the investors in the power plants, the consumers of the Baltic countries would be likely to use more NPP generated energy for a relatively higher price, thus generating the return on investments to investors.

In addition, apart from the Visaginas NPP, the Baltic NPP and the Astraviec NPP, Poland and Estonia are also discussing the projected construction of nuclear power plants on their territories. With 60% of the current energy consumption generated through coal power, by 2030 Poland expects to generate about 15% of the required energy in nuclear power plants. The Nuclear Power Programme for Poland approved by the resolution of the Council of Ministers of the Republic of Poland in 2009 provides for the construction of at least two nuclear power plants in the country: it is projected to build a 1000 MW capacity nuclear power plant by 2020 and to achieve the installed capacity of nuclear power plants of at least

4500 MW by 2030. The plans were reviewed afterwards, and it is now projected to have the first nuclear power plant of the capacity amounting to as much as 3000 MW as early as 2020–2022 (the value reaching approx. 10 billion euro). Not only is Hitachi Ltd. (part of the consortium GE Hitachi Nuclear Energy Americas), which has already stepped into Lithuania, offering nuclear technologies to Poland but also French EDF and Areva and the American-Japanese company Westinghouse Electric Company. With the increasingly stringent EU requirements on CO₂ emissions, hardly reconcilable positions of the countries in the VNPP project, the growing demand of energy in Poland and Germany (which has refused large-scope electricity generation capacities), the local market size and other circumstances in mind, Poland's plans to construct its own NPP are sufficiently realistic. Nevertheless, to meet its ambitious goals, Poland has to solve serious problems in relation to financial, technical and environmental aspects of NPP construction in a short term.

In 2009 the Estonian Government approved the National Energy Sector Development Plan until 2020 and the National Electricity Sector Development Plan until 2018, which anticipate the construction of a nuclear power plant on the territory of Estonia by 2023. It is projected to adopt the required amendments to the Estonian legislation by the end of 2012. However, at present the Estonian plans can be seen as merely theoretical possibilities, “fallback” variants or simply a method of imposing pressure in the negotiations over the VNPP or other projects. Hence, if the electricity demand in the region does not rise by 20–30% per year (for instance, due to the rapid development of electric vehicles or other similar factors which are difficult to forecast or are little likely), Estonia should give priority to the construction of the NPP in Lithuania for the reason of the NPP related costs, a small Estonian market, limited export possibilities, lack of experience in this sphere and other factors.

2.2. Role of International Instruments in the Implementation of the Visaginas NPP Project

There is no doubt that the prospects of the VNPP do not only depend on the progress of negotiations with the project partners but also on Russia's determination to implement the BNPP and the ANPP projects. It is difficult for Lithuania to talk Moscow and Minsk out of construction of nuclear power plants through the measures of indirect pressure (such as the criticism regarding the process of construction of nuclear power plants in international forums, support to public campaigns highlighting environmental issues in the Baltic and Nordic

countries, Ukraine, Russia and Belarus, complaints to international institutions and courts). Also, Lithuania has few measures that would produce direct impact. Therefore, Lithuania chooses a different road – to draw the EU institutions into the discussion; to take advantage of the IAEA, UN Secretariat, other international formats. For instance, at the IAEA General Conference in September 2011, the Lithuanian representatives brought up the issues of safety of nuclear power plants, compliance with the international commitments and conventions, and highlighted the non-conformity of the BNPP and the ANPP with the highest international standards of nuclear safety. Similar methods are applied to raise the awareness of the issues of nuclear (non)safety and construction of specific nuclear power plants in Belarus and Kaliningrad in the framework of the OSCE and the EU. At present, the members of international organisations take diverging positions on the said issues but it is nevertheless possible to convert the problems that the international institutions are essentially aware of to specific instruments in respect of the neighbouring nuclear power plants through the chairmanship in international organisations, the growing concern over energy, in particular nuclear safety.

With reference to the EU instruments, the EU Commissioner for Energy Günther Oettinger himself had paid attention to the isolation of the Belarusian regime and the lack of transparency. However, he acknowledged that the EU institutions (the European Parliament and the European Commission) did not have efficient instruments for making an impact on Minsk. In fact, he was more optimistic in terms of the impact on Russia; he had hoped that Moscow would agree to carry out ‘stress tests’ in the NPP of the country (in particular, if they were planning to export electricity to the EU)²². Nevertheless, Oettinger believes that it will be essentially difficult to block the import of electricity produced by the BNPP to the EU. If the construction of other NPP of similar safety level in the Baltic States becomes the key motive, it is generally naïve to expect that the EU will assume any ambitious measures against the NPP constructed beyond the borders of the EU and in non-conformity with the principles of the Espoo Convention. The obstacles which are most difficult to overcome in this context are the limits of application of the EU law and the plans of the EU Member States to import electricity from the reactors operating in the neighbouring countries.

However, the European Council has already paid attention to the growing public concern – on 25 March, the EU leaders applied to the European Commission and the European Nuclear Safety Regulators Group, requesting that they set the criteria and the scope of their application to the tests which the independent

²² As shown by subsequent events in 2011, under the EU pressure, Moscow and Minsk undertook to carry out ‘stress tests’ but their performance reports were never submitted.

national bodies would carry out in European countries. According to the Prime Minister of Spain Rodríguez Zapatero, the reactors that “failed” in the tests would have to strengthen their safety or be shut down altogether. It would be in the best interest of Lithuania to take advantage of the opportune moment to achieve the point that the said initiative would extend beyond the EU countries: the European Commission was already asked to consider how to promote the compliance with nuclear safety requirements in the neighbouring countries. In the case ideal for Lithuania, it would mean the creation of a platform through which the EU could make an impact on the development of nuclear energy in the third countries. The conditionality principle-based PHARE nuclear safety program, the Nuclear Safety Co-operation Instrument (NSCI) replacing the TACIS instruments in this sphere, the EU Regulatory Assistance Management Group (RAMG) supporting the implementation of the latter, also the committee set up by the European Commission to solve the nuclear safety cooperation issues in the third countries could become the key instruments of impact on the third countries.

Concerning other instruments of impact on Russia and Belarus, the IAEA Fundamental Safety Principles (2006) targeted at public and environmental safety are worthy of repeated mention. The said principles provide for several requirements which may be invoked by the Lithuanian Government in the negotiations with Belarus and Russia (by the way, one of the principles maintains that it is governments that shall assume responsibility for the implementation of safety requirements). According to one of them, facilities and activities that give rise to radiation risks must yield an overall benefit. Lithuanian scientists believe that an unacceptable risk to the city of Vilnius would arise in the case of a nuclear accident. Hence, in the event of a failure to “persuade” the neighbours into discontinuing the construction of reactors, Lithuania could at least request that they dislocate the nuclear power plant construction sites to a greater distance from Vilnius (thus potentially reducing the damage inflicted by incidents or at least delaying the beginning of construction).

However, viewed objectively, Lithuania’s argument can be disputed from the background of the constructions already in progress. The problem is that the permissible distance from a nuclear power plant to the capital of another country is not governed by international agreements. What is more – Vilnius would not be the sole capital in Europe with a nuclear reactor of another country constructed in the vicinity²³. The reluctance of Russia to ratify the Espoo Convention²⁴

²³ The capitals of Luxembourg, Denmark and Croatia are at a distance smaller than 50 kilometers from the nuclear power plants of other countries.

²⁴ Though Belarus ratified it, it did not essentially comply with the convention in the preparatory stage of construction.

and a technical (rather than political) role of the IAEA in this context are other obstacles that are not very easy to overcome.

Through Lithuania's OSCE chairmanship in 2011, Lithuania sought to bring the issues of nuclear safety on the agenda of this organisation. Bearing in mind that the OSCE brings together 56 states, including the US and Russia, the OSCE mechanism of response to accidents and other emergency situations, the early warning system or similar instruments applicable in the OSCE framework could be more efficient. The striving for good governance and publicity, stability and predictability, investment protection, market openness, efficiency, diversification and solidarity could become the principles of cooperation in this sphere, according to Lithuania. After the evident EU hesitation in the Fukushima accident, Lithuania tried to reach a consensus of the member states on the setting-up of a task force in the session of the Ministerial Council closing Lithuania's chairmanship in the OSCE. The task force would seek to coordinate the positions of the member states on the principles of the OSCE involvement, to analyse the situation, to assume the required actions to prevent potential crises from occurring or to mitigate the outcomes of emerging crises, as well as to promote the publicity and good governance through the existing mechanisms. The task force could not be established at the time of Lithuania's chairmanship (essentially due to Russia's opposition) but the idea can be again brought forward should the occasion arise.

3. Impact of Nuclear Energy Development on the Security of the Baltic States

3.1. Impact of Cooperation in the VNPP Project on Regional Cooperation

On 27 February 2006, at the meeting in Trakai, the Prime Ministers of Estonia, Latvia and Lithuania signed the first communiqué supporting the initiative to construct a new nuclear power plant in Lithuania. Lietuvos energija, Latvenergo and Eesti Energia were invited to invest in the design and construction of the new nuclear power plant in Lithuania on equal terms. On 8 March 2006, the state-owned energy enterprises Eesti Energia, Latvenergo and Lietuvos energija signed a memorandum on the construction of a new nuclear reactor in Lithuania. It provided for the participation of the parties under equal conditions and the coverage of costs relating to common interests in equal shares. The follow-up documents replaced certain aspects of the said agreements but the very

substance remained unchanged – Lithuania, Latvia, Estonia and Poland (which resolved to contribute to the project in the short run) still declare their political support to both the construction of the VNPP and the construction works of the infrastructure relating to the distribution (export) of energy generated in it.

The practical implementation of these agreements definitely depends on a broader context of the Baltic-Polish relations (which is not necessarily positive). However, a breakthrough in the negotiations with the promoters of strategic projects and a closer integration of energy sectors once the said projects are completed should make a positive impact on the securitization of certain topical problems in bilateral relations. In this context, Lithuania is hoping for the support from Polish, Latvian and Estonian diplomats in limiting the import of the electricity produced in unsafe nuclear power plants of the neighbouring countries to the EU. Occasionally, Lithuania does receive it – we may recall the meeting of the representatives of the Baltic States, Poland and the European Commission held in December 2010 where they resolved to establish and maintain common policy goals targeted at the trade with the third countries that do not belong to the European Economic Area (EEA). This idea, by simultaneously highlighting the necessity to integrate the Baltic States to the EU internal electricity market, was also included into the communiqué signed between the ministers of energy of the Baltic countries and Poland on 31 May 2010 (it is important to note that the European Commissioner for Energy attended the ceremony of signing the said communiqué). Hence, the discussion on the prospects of implementation of strategic energy and transport projects has already become a common item on the agenda in the meetings of Lithuanian, Latvian, Estonian and Polish presidents, prime ministers and ministers. Should this tendency continue, energy projects and coordination of initiatives in this sphere have a realistic opportunity to become the catalyst for the improvement of relations among the countries in the region.

However, it must not be forgotten that the interests of Lithuania, Poland, Latvia and Estonia in respect of the new nuclear power plant in Lithuania as well as the potential limitation on import of electricity from Kaliningrad and Belarus, are still rather divergent. In the beginning of his term of office, the President of Latvia Andris Bērziņš openly doubted the capacities of his country to participate in the joint project of construction of the VNPP due to lack of resources. It should be noted that after his visit in Vilnius and the meeting with the President of Lithuania, as well as the discussion on all the projects of regional relevance, the President of Latvia declared that the energy enterprise Latvenergo would continue its participation in the VNPP project and contribute to developing such a model of control of the nuclear power plant that would best meet the interests of Latvian

residents²⁵. However, it was followed by the declaration of the Polish company PGE of December 2011 on its decision to freeze participation in the VNPP project²⁶. Similar differences of opinion emerged in discussing the limitation on electricity import from the BNNP and the ANPP – Poland and Latvia are essentially concerned with as broad import possibilities as possible, whereas Lithuania would like to block the import from “unsafe” power plants right now or at least from 2020 (when the Visaginas NPP is expected to be put to operation). In principle, additional flows of electricity import until 2016 when the Narva oil shale fired power plant will be shut down are not in Estonia’s interest as well. After this date, Tallinn will seek to diversify the import of electricity at the earliest possible opportunity and on the broadest possible scope; hence, it would probably not be willing to limit the import from other countries. It will be rather difficult to coordinate the said national differences of opinion since the “concessions” made by the countries (i.e. the support to the interests of another country) would have a direct influence on their supply with electricity. If the disagreements on the common position are increasingly commonplace, it may result in the deterioration of relations in other areas as well.

3.2. Role of Nuclear Energy in Reducing Energy Dependence

Today, the raw materials used to produce the fuel for nuclear power plants are available from Australia, Kazakhstan, Russia, and Canada. Some 60% of raw uranium mined in the world belongs to Australia, Kazakhstan and Canada, and the former two have the largest resources of raw uranium at their disposal. Russia has less than 9% of the world’s uranium resources.²⁷ Furthermore, regarding the enrichment of uranium to the level appropriate to a NPP, Russia is also neither the sole provider of this service nor the monopolist of its market. The Russian company Rosatom has exclusive rights of uranium enrichment for its manufactured VVER-type reactors in the EU but Rosatom/Tenex group of companies supplies fuel to 28% of reactors worldwide only. The uranium enrichment capacities offered by the German, Dutch, British and American company Urenco and the French company Areva can fully satisfy the internal needs of the EU; the said

²⁵ LETA-ELTA ir lrytas.lt, *A. Bērziņis pabrēžia ekonomijā Visagino elektrinēs aspektā* [Andris Bērziņš highlights the economic aspect of the Visaginas Nuclear Power Plant], http://www.lrytas.lt/-13136700811311864264-a-b%20C4%97rznis-pabr%20C4%97%20C5%BEia-ekonomij%C4%AF-visagino-elekttrin%C4%97s-aspekt%C4%85.htm?utm_source=rss&utm_medium=rss&utm_campaign=rss, 18.08.2011 (in Lithuanian).

²⁶ In fact, the declaration was immediately followed by assessments that such a step of the company was not coordinated with the Polish Government and the head of the company resigned.

²⁷ Nucleus, *Paneigiam mitus*, http://www.vae.lt/files/nucleus_specialus_numeris.pdf, p. 8, 10.11.2011.

companies supply fuel to 43% of reactors operating worldwide²⁸. In other words, an assumption that the development of nuclear energy reduces the country's dependence on the supply of resources from a single country is essentially correct.

Table 1. Uranium mining and enrichment²⁹

COMPANY/ COUNTRY	URANIUM CONVERSION (necessary before enrichment)	URANIUM ENRICHMENT
	(% of the total amount, 2009)	
Atomenergoprom (RF)	32.9	45
Cameco (CAN+UK)	24.3	-
ConverDyn (USA)	19.7	-
Areva (FR)	19.1	-
CNNC (China)	3.9	2.2
Urenco (UK-Ge-NL)	-	20.3
Eurodif (FR)	-	18
USEC (USA)	-	13.3
JNFL (Japan)	-	0.3

Table 2. Production of nuclear fuel³⁰

Country	URANIUM RESOURCES	URANIUM MINING
	(% of the total amount, 2009)	
Australia	22.5	15.7
Kazakhstan	13.7	27.4
Canada	8.4	20.1
Russia	8.4	7
South Africa	8.2	n.d.
Niger	5.8	n.d.
Namibia	5.1	n.d.
Ukraine	3.8	n.d.
Uzbekistan	2.1	4.8
USA	n.d.	2.9

²⁸ Neely G. R., *The Uranium Enrichment Market*, <http://www.usea.org/Publications/Nuclear%20Briefings/The%20Uranium%20Enrichment%20Market%20-%20Ux%20Consulting.pdf>, 10.08.2011.

²⁹ Ibid.

³⁰ Ibid.

3.3. Financial and Economic Aspects of Construction of a Nuclear Power Plant

Several aspects have to be highlighted when discussing the price of energy generated by nuclear power plants. First of all, it is not fuel, power plant maintenance or energy transfer costs that make up the largest share in the net price of energy produced in a nuclear power plant, but the costs of construction of the power plant itself. According to the estimates of the International Atomic Energy Agency, the investments to the construction of a power plant (according to the average construction costs of nuclear power plants in Canada, Japan, Spain, the USA) accounts for more than 60% of the final energy price. Fuel makes up only ~15% of the final energy price³¹. For the sake of comparison: fuel costs in gas-fired power plants make up 70%, whereas investments to power plants account for 25% of the final electricity price. However, the often overly optimistic nuclear power plant decommissioning costs should also be added to the price of nuclear energy.

In the meantime, neither experts nor politicians can give a clear answer to the question as to how much the VNPP will cost and whether the price of electricity generated by it will be competitive. Some economists highlight enormous construction costs of the VNPP – according to their estimates, the price of the nuclear power plant could reach some 12 billion litas; the addition of extra costs and interest could boost the price to over 20 billion litas³². By contrast, Rimantas Vaitkus, Director of External Affairs at the VNPP, believes that even inclusive of all the costs (construction and equipment of the power plant, capital costs, loan interest costs, fuel costs, maintenance and operation costs, taxes, etc.), the price of nuclear energy in Europe (12.5 – 20 ct/kWh) is lower than the price of the energy produced by means of combustion of natural gas (20 – 30 ct/kWh) or using wind energy (21.5 – 40 ct/kWh)³³. When comparing the price per kilowatt-hour, Lithuanian scientists note that the net price of electricity generated in the gas-fired Lithuanian power plant in Elektrėnai currently equals to 31 ct/kWh. In 2011, Lithuania could purchase electricity from Russia at the price of 19-20 ct/kWh. By contrast, the price per kilowatt-hour of nuclear energy in the currently operating power plants varies from 0.04 – 0.3 USD/kWh (in LTL – 8-77 ct/

³¹ *The Economics of Nuclear Power*, <http://www.world-nuclear.org/info/inf02.html>, 12.08.2011.

³² Rudzkis R., *Kiek kainuos VAE gaminama elektros energija? [How much will the electricity generated by the Visaginas NPP cost?]* <http://www.delfi.lt/news/ringas/lit/rudzkis-kiek-kainuos-vae-gaminama-elektros-energija.d?id=50295440>, 13.10.2011 (in Lithuanian).

³³ *Visagino AE ir ekonominiai niuansai – ką naudingai žinoti [Visaginas NPP and economic nuances – facts you should know]*, <http://www.enmin.lt/lt/komentarai/detail.php?ID=1609>, 20.10.2011 (in Lithuanian).

kWh). Hence, the key question is: how much will the construction of the NPP and its putting-into-operation cost and what will be the price of gas, oil products and renewable energy resources at that time?

It is rather difficult to evaluate the price of traditional and renewable resources in ten years – it will definitely depend on economic, financial and political situations in developed countries, as well as the region's rapid development. However, with technologies gradually developing, the reduction in the net price of renewable energy resources can be observed in several recent years – a number of experts assume that such a tendency should persist³⁴. The resources of oil and natural gas are gradually shrinking; therefore, their extraction costs should show an upward trend in the future. As regards the VNPP construction costs, the loss of some orders by Hitachi corporation after the Fukushima accident is in the best interest of Lithuania and its regional partners. To achieve at least a partial compensation of the losses incurred, the said company may offer more favourable conditions of construction of a nuclear power plant. Furthermore, after the shut-down of the Ignalina NPP in Lithuania, the infrastructure required for the operation and maintenance of a NPP in Lithuania remained in a rather satisfactory condition; Lithuania still has the specialists with the required expertise in nuclear energy production (new experts are being prepared as well). In principle, the general public supports the construction of the NPP – it determines lower costs for public relations. Finally, the construction of the NPP is one of the key priorities of the Government in the development of energy infrastructure – it guarantees an important political support and reduces the costs of project implementation. These factors play an important role in negotiating the contribution of Lithuania and other stakeholders in the project (for instance, we may expect that seeing the government's support to the project and evaluating it as one of a more important steps in the prospective restoration of its standing in the world and the establishment of its position in the local (Northern European region) market, the investor will agree to arrange a return-on-investment schedule for a longer period than usual). However, some experts note that the final price of nuclear power plants is always 2-5 times higher than initially projected³⁵. Therefore, we should not reject the pessimistic scenario that, in view of the growing competition (and risk), the

³⁴ COM(2006) 848, 10.01.2007 (*Communication from the Commission to the Council and the European Parliament – Renewable Energy Road Map – Renewable energies in the 21st century: building a more sustainable future*), 4.3.

³⁵ Vilemas J., „Branduolinės energetikos plėtros problemos atviros rinkos šalyse ir jų pamokos Lietuvai“, konferencija „Lietuvos energetika po ekonominės krizės ir Ignalinos uždarymo“ [“Problems of Development of Nuclear Energy in Open-Market Economies and Their Lessons to Lithuania”, conference “Lithuanian Energy in the Aftermath of the Economic Crisis and the Shutdown of the Ignalina Nuclear Power Plant”], 26.09.2011 (in Lithuanian).

investor may try to force the negotiators of the Baltic States and Poland into the commitment over the conditions that would guarantee a more speedy (or stable) return on investments, thus resulting in a higher electricity price to the consumers in the region.

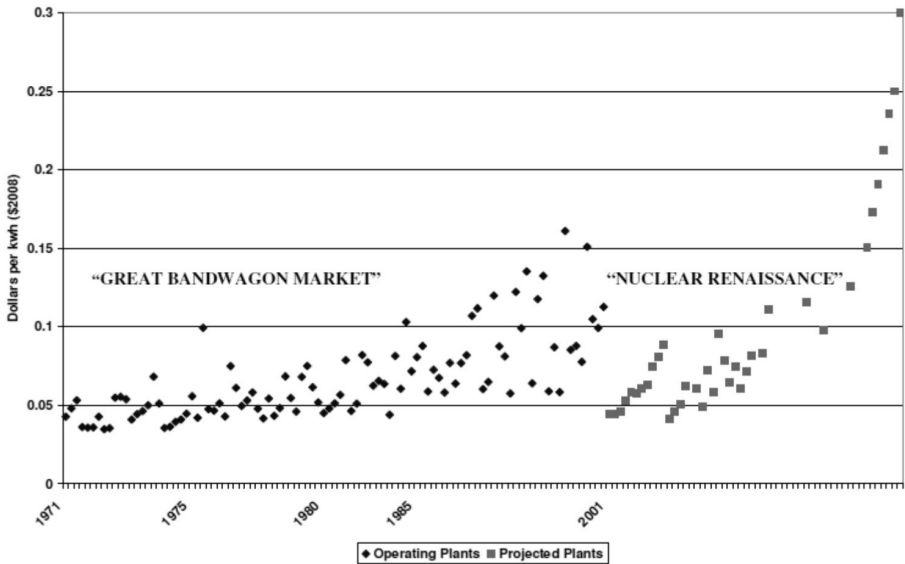


Figure 2. Cost of energy produced in a nuclear power plant³⁶

3.4. Reactor Safety Problem

In the decision-making over the NPP construction, safety issues are as important as investments, technical power plant parameters, international cooperation and other related factors. As regards nuclear energy, safety is understood in two aspects: a) as prevention of unintentional conditions or events determining a nuclear leakage from a NPP and b) as protection from intentional actions causing damage (for instance, terrorist attacks against NPP or nuclear fuel storage facilities). Regarding the environmental aspect of safety, a comment made by Anne Lauvergeon, a representative of the French company AREVA, is worth mentioning, according to which nuclear energy determines the reduction in the

³⁶ Cooper M., *The Economics of Nuclear Reactors: Renaissance or Relapse?*, Institute for Energy and the Environment, Vermont Law School, 2009, p. 12.

annual carbon dioxide emissions by 630 million tonnes³⁷. In other words, those arguing that nuclear energy is not and may not be totally safe in environmental terms should not forget another aspect – in 2009, electricity generators released as much as 9 billion tonnes of carbon dioxide to the environment (out of 30 billion tonnes of the total pollution generated by industry and 50 billion tonnes of the total carbon dioxide emissions). It is estimated that once nuclear energy is phased out and the same amount of electricity is generated, 11 billion tonnes of carbon dioxide would be released to the environment. Furthermore, according to the data of the United Nations Environmental Programme, to reduce global warming by at least 2C, the total volume of CO₂ emissions should be reduced to at least 44 billion tonnes by 2020. If no measures are taken, by 2020 CO₂ emissions will amount to 54-60 billion tons; with ambitious goals, pollution can be reduced to 49 billion tons – the “surplus” of 5 billion tonnes would nevertheless remain. Thus, 2 billion tons which nuclear energy could save, do not guarantee a substantial breakthrough but it is still a factor of considerable importance.

Table 3. CO₂ emissions and impact of nuclear energy

CO ₂ emissions in 2009		
Total	50 billion tonnes	
Industry	30 billion tonnes	
Electricity production	Present	9 billion t
	If nuclear energy was phased out	11 billion t
	“Saved”	2 billion t
CO ₂ emissions in 2020		
UN plan to reduce global warming by 2C	44 billion t	
Forecasts if no measures are taken	54-60 billion t	
Forecasts if immediate measures are taken	49 billion t	
Surplus in the best case	5 billion t	

Conclusion: 2 billion tonnes which could be “saved” by nuclear energy do not guarantee a substantial breakthrough but it is nevertheless a factor of significant importance

The year 2012 will most likely witness the endeavour to conclude a global and legally binding agreement on the issues of climate change – once the developing countries agree to meet the objectives which they can and are willing to pursue, the utmost responsibility for the reduction in CO₂ emissions will most likely fall on the EU Member States. Therefore, a number of the EU coun-

³⁷ Bigot, B., Safe Management of Nuclear Waste, *The European Files*, 22, 2011, p. 34.

tries developing nuclear energy do not seek to “get rid of” nuclear energy but to strengthen nuclear safety and to develop the systems of radiation monitoring and early warning. In April 2011, the participants of the Review Meeting of the Convention on Nuclear Energy highlighted that the new NPP should be built in close cooperation with the neighbouring countries exclusively; decisions on a construction site must be without prejudice to the IAEA safety standards focusing on the NPP impact on people, society and environment. At this meeting, the representatives from Lithuania supported the Action Plan on Nuclear Safety drafted by the IAEA Director General, according to which not only the requirements but also the recommendations drawn by the IAEA would be binding to the countries. Furthermore, all countries developing nuclear energy should transpose the provisions of international conventions on nuclear energy into the national law, to establish an independent regulatory body supervising the compliance with the requirements of nuclear safety, etc. It proposed to adjust the applicable IAEA safety standards to contemporary circumstances, to update the requirements of design, operational management, structural reliability and prospective decommissioning, and to take into account seismic threats and climate change (the growing number of hurricanes, floods, droughts, etc.).

When assessing the NPP resistance for terrorist and other targeted attacks, the recent growth of concern of the international community with this safety aspect deserves special notice. The majority of experts³⁸ conclude that nuclear reactors would withstand terrorist attacks much better than any other buildings. For instance, the 2002 study of Electric Power Research Institute (EPRI) maintains that in the US, NPP nuclear reactors could withstand the impact of a fully-fuelled Boeing 767-400 of over 200 tons as the basis flying at the maximum speed of 560 km/h³⁹. Besides, there is only a very tiny chance for an aircraft to crash straight into a NPP, the more so to the location of a NPP where a nuclear reactor is situated. According to the 2003 study carried out by the Swiss Federal Nuclear Safety Inspectorate,⁴⁰ the chances of radioactive leakage after an aircraft crash are low in older-generation NPP of the country, and especially low in more modern NPP. Similar results were identified for a hypothetical terrorist attack against the used fuel storage facilities: radioactive particles would not be released into the environment in the event of an

³⁸ For instance, see *Deterring Terrorism: Aircraft Crash Impact Analyses Demonstrate Nuclear Power Plant’s Structural Strength (EPRI Study)*, <http://www.nei.org/resourcesandstats/documentlibrary/safetyandsecurity/reports/epriplantstructuralstudy/>, 26.09.2011 and Chapin D. M., et al., *Nuclear Power Plants and Their Fuel as Terrorist Targets*, *Science Magazine* 297 (5589), 2002, p. 1997-1999.

³⁹ According to the authors of this study, not even an armoured-concrete containment building would be damaged in the event of an attack (it could only be damaged by several repetitive strong strikes).

⁴⁰ For the study “Stellungnahme der HSK zur Sicherheit der schweizerischen Kernkraftwerke bei einem vorsätzlichen Flugzeugabsturz”, see: http://static.ensi.ch/1312876660/fla-bericht_maerz03.pdf.

attack. Despite that, in the aftermath of the 11 September attacks, the USA worked to strengthen the safety of NPP in the country: it reformed and retrained security personnel, strengthened plant access control, surveillance and intrusion detection systems, etc.⁴¹

When evaluating the safety of nuclear reactors in this context, conclusions on safe or unsafe reactors will definitely depend on the country and the approach of the NPP operator towards this problem. For instance, being one of the leaders of nuclear energy development, France continues to invest in nuclear energy and its safety. To reduce the pollution to an even greater extent, the used fuel is recycled (the processes of enrichment of uranium and plutonium are repeated) and repeatedly used or safely buried in deep geological layers (500 m deep). In the meantime, Russia is indeed facing difficulties in solving the safety problems of nuclear reactors of both types. We may remember the collapse of steel carcass structures at the site of the Leningrad NPP-2 under construction in 2011, which were supposed to protect the plant from external impact and to contain radiation in the event of a nuclear accident. In this context, it is worth mentioning the official 150-page report of the Russian Government presented at the meeting of the State Council of 9 June 2011⁴², which listed as many as 32 problems identified in nuclear power plants in Russia – starting with a lack of tests for potential shocks that could be caused by natural phenomena and ending with the absence of control of the storage of potentially explosive materials⁴³. In the case of the VNPP, we may expect that the severe experience of the selected investor in Japan, the obligation to comply with the EU requirements and international agreements, project internationality and the focus on environmental issues in the discussion on the safety of reactors in the neighbouring countries should guarantee relatively scrupulous attention to the safety of a nuclear reactor in Lithuania and its safe operation respectively.

Conclusions

After the Fukushima nuclear accident, public trust in nuclear energy slumped from 45-75% to 21-51% across the globe. Governments are forced to

⁴¹ United States Nuclear Regulatory Commission, *Force-on-Force Security Inspections*, <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/force-on-force-fs.pdf>, 07.09.2011.

⁴² The report became public after it fell into the hands of the environmental NGO Bellona based in Norway.

⁴³ The said document states that the nuclear power plants in the country are not as safe as it was thought, in particular as regards their safety in the event of an earthquake (none of the nuclear power plants was tested for the shock which could be caused by an earthquake); the seismic level of most of the NPP sites is underestimated; some NPP “do not have an automatic shutdown mechanism” for the case of earthquakes.

react to such public opinion – some do it by reviewing the reactor safety requirements and strengthening the control of compliance with them, while others shut down unsafe nuclear power plants and refuse to plan the construction of new reactors. It is not very difficult to make nuclear phase-out decisions if there is political will – the useful life of a number of nuclear power plants in operation is running out anyway (the average useful life of reactors operating for an average period of 40 years is 27 years), and the energy generated in nuclear reactors makes up barely 14% of the total electricity consumption worldwide. Other arguments are no less strong: catastrophic outcomes of potential accidents, vast construction costs of nuclear power plants (due to more stringent safety requirements after the accident in Japan, nuclear reactors are expected to get even more expensive), pending problem of storage of used nuclear fuel, and substantial risk of operation (in the event of a nuclear accident, similar reactors running in other spots of the world may be shut down for safety reasons). A long and complex process of NPP construction, reducing costs of energy generation from renewable energy resources, as well as rapidly developing shale gas and energy saving technologies are equally deterrents to motivating the construction of new NPP. The NPP decommissioning also requires a special mention – the examples of the Ignalina NPP and the Greifswald NPP show that on the average the shutdown of a NPP costs over 3 billion euro⁴⁴.

As regards the EU, we should probably have no doubts that the requirements relating to reactor safety will get tighter at the initiative of the Member States taking an opposing position in respect of nuclear energy development; the shutdown of the reactors failing in ‘stress tests’ will be required. Notwithstanding the above, international organisations place the share of nuclear energy at the range of 5–12.5% in the total primary energy balance for 2050, whereas in electricity production nuclear energy may account for 9–22% (at present – 16%)⁴⁵. In other words, the “sceptics” will most likely fail in contesting the “rational need” of Finland, France, the Czech Republic, the UK, the Netherlands and other countries to construct new-generation reactors. The failure of the European Parliament to adopt the resolution on nuclear energy is an excellent illustration of the difference of opinion within the EU, whereas the instruments of the general EU energy policy

⁴⁴The NPP decommissioning is not an issue of exclusively national importance for other than solely financial factors. For instance, Germany’s unilateral decision to phase out nuclear energy by 2022 received the criticism from both the EU Commissioner Günther Oettinger and the Member States. There is no doubt that the decision taken by Germany will affect the energy infrastructure development plans of its neighbours and across the EU.

⁴⁵World Nuclear News, *Another drop in nuclear generation*, <http://www.world-nuclear-news.org/newsarticle.aspx?id=27665&terms=another+drop+>, 05.10.2011.

do not yet have enough power to force France, for instance, to phase out nuclear energy. Therefore, the projects implemented by the EU Member States may become less ambitious, while some of them may be postponed, but the complete freeze of constructions can hardly be expected. The companies operating in the nuclear industry of the EU Member States may even benefit from the Fukushima accident – the manufacturers of new-generation “safer” reactors will get an excellent opportunity to justify their far higher prices.

The prospects of construction of the VNPP can also be evaluated in this context. The Lithuanian Government puts forth every possible effort to prevent the construction of the BNPP and the ANPP, while Poland and Estonia would contribute to the construction of the VNPP. The discussions on the construction of national nuclear power plants in Estonia can be treated as an objective to have a fallback plan in case the VNPP project failed. “Nuclear” plans in Poland, Russia and Belarus are a far more complex problem. Based on the progress made in project implementation, the VNPP is said to surpass the nuclear power plant in Kaliningrad by some three years. It is good news for the implementers of the VNPP project because the ability to ensure favourable conditions for selling the electricity generated in the VNPP before it is done by the stakeholders in the BNPP project is one of the key conditions of implementation of the VNPP project. Poland’s determination to invest in the construction of local nuclear power plants may not only determine the increase in the tension in bilateral relations with Lithuania but also the need to review the strategy and the deadlines of construction of a nuclear power plant in Lithuania. However, in its primary stage, the VNPP project was planned without Poland’s participation; therefore, Poland’s withdrawal should not make essential influence. The process of construction of a nuclear power plant in Belarus is not in the best interest of Lithuania as it reduces the confidence in nuclear energy in general. Hence, we may conclude that the pace of implementation of the VNPP project will depend on the following circumstances: 1) the faculty of the three Baltic States and Poland to agree on the conditions of investment and the distribution of powers in the new nuclear power plant; 2) the capacity of the three Baltic States and Poland to agree with the company Hitachi awarded the contract in the tender on the conditions of construction of the VNPP in favour of the countries participating in the project; 3) the ability to solve the key problems of financing of construction of the VNPP and the disposal of used nuclear fuel; and, 4) the pace of construction of nuclear power plants in the neighbouring countries.