

## Lithuania increase networking after joining the EU

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**Abstract.** In 1990, after Lithuania declared its independence, the Ignalina NPP came to jurisdiction of the Republic of Lithuania, however, all technical scientific support organizations remained in Russia. Therefore the need to develop the independent institutions of nuclear regulatory and technical support was raised. During the 1991 – 2009 (till the final close of Ignalina NPP) the necessary infrastructure for nuclear regulation and technical-scientific support was created. Lithuanian Energy Institute (LEI) became the main technical support organizations in Lithuania, capable to perform all necessary safety analyses for Ignalina NPP. The support of Western countries and experience, received participating in different international projects, was very important during the process of experience acquiring. Lithuania's accession to the EU (2004) has opened wide horizons for cooperation. Active participation in European research programmes was very important to Lithuania since it allows Lithuania to further integrate into the European Research Area, benefiting both Lithuanian researchers and country as a whole. Lithuania is actively participating in the European research programmes (FP6, FP7) and this is the basis for successful participation in the biggest EU Research and Innovation programme Horizon 2020. However, evaluating the differences in research infrastructures between the “old” and “new” EU Member States, there is only way for new EU states to participate on equal basis with the EU-15 countries – to join forces and work together.

### 1. Introduction

In 1990, after Lithuania declared its independence, Ignalina NPP came to jurisdiction of the Republic of Lithuania. Lithuania inherited Ignalina NPP from the Soviet Union together with the responsibility to ensure safe operation of the plant, but all technical scientific support organizations remained in Russia. Therefore raised the need to develop the independent institutions of nuclear regulatory and technical support. The State Nuclear Power Safety Inspectorate (VATESI) was established by Government resolution in October 1991. VATESI approves nuclear safety rules and guides, issues licences for the activities related to nuclear safety and controls adherence to the requirements set out in licences and safety rules. Since 1991 till the closure VATESI has regulated Ignalina NPP operation by issuing annual operating permits. However, the nuclear regulator cannot act alone – the technical and scientific support is one of the important provisions for maintaining nuclear security systems in States. The technical and scientific support organizations (TSOs), which providing the technical and scientific basis for decisions regarding nuclear and radiation safety, could be as part of the regulatory body or a separate organizations. In Lithuania the creation of TSOs starts together with the establishment of VATESI. In March 1992 at the Lithuanian Energy Institute in Kaunas the Ignalina Safety Analysis Group (ISAG) was established. The goals of ISAG were to gain a thorough understanding of the basic processes of RBMK-1500 reactors; to gather and analyze design and operational data; to record and rank safety issues at Ignalina; to analyze the consequences of simulated accidents at the plant; and to provide professional

technical and scientific consultation to the VATESI, the government and the international community. Later this group overgrows into Laboratory of Nuclear Installation Safety. The other organizations also took income into creation of TSOs – the temporary groups of specialists were created in Kaunas University of Technology (KTU), Vytautas Magnus University (VMU), Faculty of Physics of Vilnius University (VU) and the Institute of Physics (IP).

## **2. Support of Western countries for creation of the regulatory regime and TSOs in Lithuania**

The newly created Lithuanian nuclear regulator organisations would not have been able to perform its functions without the transfer of Western knowledge and techniques. This has been of particular value to VATESI and its own TSOs in the areas where techniques or analysis tools have been developed in the West or where the subject did not receive extensive attention in the former Soviet Union. The training has been provided by the Western TSOs via the support of the European Commission in a series of PHARE projects, and also in a number of programmes of bilateral support from member countries. The following are examples of the areas of training provided for VATESI and its TSOs.

At the very beginning it was a very important to lay a foundations – to transfer the fundamental safety principles and to train Lithuanian nuclear regulator and TSOs regarding the Lines of Defence Methodology. This technique was initially developed in France and further upgraded for special applications in the UK. It is valuable for making judgements of the acceptability of defence in depth, especially when a facility has been built to earlier standards and has features which are not typical of the majority of current designs. Also very important were the experience about the Safety Case production and review. This training aimed to show the importance of well-argued safety justifications and how they differ from bare reporting of analysis. The Lithuanian specialists learned how to assess the quality of Safety Cases and carry out formal review. This was important for the major Safety Cases reviewed by VATESI in the preparations for Unit 1 and 2 licensing.

To strengthen the co-ordination of the various bilateral and international assistance programmes to VATESI in view of their work related to granting a licence for continued operation to INPP Unit 1, the Licensing Assistance Project (LAP) was created. A Steering Group was formed in October 1996 with participants from six involved countries (France, Finland, Germany, Sweden, UK and the US). The LAP Steering Committee meets regularly about four times a year. In addition, workshops on critical technical issues were organised by LAP. The LAP Steering Group receives reports on the progress with safety improvement measures, disseminates technical information between its member organisations, and co-ordinates activities underway in international and bilateral assistance projects in order to avoid duplication and to promote synergy. Technical issues important to VATESI's regulatory work were evaluated and advice was offered to assist in the preparation of regulatory decisions. This assistance activity was very good school and the support for the VATESI and its TSOs.

The inspections, equipment qualification and non-destructive examination (NDE) have been important areas of training for TSOs. The specialists from Western TSOs spent great efforts on NDE and material technology which also has included transfer of equipment to the TSOs: NDE systems similar to those in use at inspections at INPP, material testing equipment and an electron microscope. Experts from VATESI and TSO have also been trained in ultrasonic technology and certified as inspectors in accordance with European Standard EN 473. TSOs have also been involved in the examination of INPP confinement building structures.

Since 1992 the specialists from LEI received the training from Germany's central expert organisation in the field of nuclear safety and radioactive waste management (GRS) in the field of core physics, thermal-hydraulics and confinement computer codes: Training has been provided in detailed use of GRS computer codes ATHLET, QUABOX/CUBBOX, RALOC, COCOSYS and SUSA. The German/Lithuanian assistance programme has also included transfer of these codes to the LEI. In the recent past training and code transfer have been extended to other Lithuanian safety organisations in order to broaden the basis of technical expertise for VATESI. Similar assistance was provided by the U.S. with regard to the RELAP5 and CONTAIN computer codes.

### **3. First attempts of networking in the nuclear energy**

It was already mentioned, that after Lithuania declared its independence, the technical support organisations in Lithuania grows and develops into institution, capable to perform all necessary safety analyses for Ignalina NPP. At the moment of final shutdown of Ignalina NPP, the Lithuanian TSOs provided the supports to the Lithuanian State Nuclear Power Safety Inspectorate (VATESI) in the form of consultations, design, research, expertise and other works requiring high scientific-technical qualification, competence, special knowledge and skills. To achieve the most efficient use of the scientific-technical potential in solving the problems of nuclear safety, the Coordination Council of Technical Support Organisations of VATESI was established, which coordinates the TSO expertise assistance to VATESI, promotes the development of nuclear energy research-industrial infrastructure, upbringing of scientific technical potential in the country and training of nuclear energy specialists.

Just before the closure of the Ignalina NPP, the deterioration of energy situation was expected. The prime Ministers of Lithuania, Latvia and Estonia signed Communique regarding cooperation in construction of the new NPP in Lithuania in February 2006. A decree endorsed by Lithuanian Parliament in June, 2007 about construction of a new NPP in Lithuania in cooperation with Latvia, Estonia and Poland. Unfortunately, at present the Lithuania, Latvia, Estonia and Poland have the shortage of nuclear energy specialists, and other energy-related professions, which are required for the new nuclear power plants planned to be constructed in the Baltic region. The knowledge on nuclear safety are required not only for NPP Operating organisation and Regulatory Body, but also the basic nuclear related knowledge should be transferred to the specialists of companies, which are interested in the NPP construction industry, infrastructure related works or other services.

The filling the existing gaps in knowledge and enhancement of competence could be performed through training seminars. At the end of 2007, the Lithuanian State Nuclear Power Safety Inspectorate (VATESI) initiated the establishment of a Regional Nuclear Safety Training Centre. This idea, discussed during an IAEA Regional Project Co-ordination meeting, raised big interest among potential counterparts (Ignalina NPP, Lithuania power company, representatives of universities and institutes), taking into account the emerging needs of new NPPs in the Baltic region. Moreover, the IAEA proposed to explore the possibility of Lithuania hosting a Basic Professional Training Course for the entire region. As a pilot project, it was proposed to organise a two-week course on nuclear safety based on the syllabus developed by the IAEA. The Regional Basic Professional Training Course was organised by International Atomic Energy Agency under the Technical Cooperation Regional Project "RER/9/084: Effectiveness of Regulatory Authorities and Advanced Training in Nuclear Safety". It was decided that host organisation and the main local organizer of course would be the Lithuanian Energy Institute (LEI). In 2008 and 2009 such two weeks courses (at the end

of October) were organised. The total number of course participants was approximately 40 each year: half of audience was composed from participants from several IAEA Member States from former Soviet Republics and East Europe (Albania, Armenia, Azerbaijan, Belarus, Bulgaria, Croatia, Czech Republic, Hungary, Kazakhstan, Poland, Romania, Russian Federation, Slovenia, Slovakia and Ukraine), and half from local Lithuanian organisations (VATESI, Visaginas NPP and others), see FIG. 1. The lecturers for the course were drafted from IAEA, but part lectures were from Lithuanian organisations (KTU, LEI, CPST and Ignalina NPP). The 16 – 18 modules from the IAEA syllabus are involved into course program: Design of nuclear reactors; Basic principles of nuclear safety; Operational safety; Radiation protection and environment control; Deterministic accident analysis; Probabilistic safety analysis; In-plant accident management; Quality assurance; Regulatory control; Limiting conditions for operation; Plant renewals, modifications and upgrades; Safety issues in non-reactor facilities; Maintenance; Decommissioning; Public communication. During the course the working groups, the technical visit of Ignalina NPP and simulator exercise (training exercise at Ignalina NPP full-scale simulator of RBMK-1500) were provided. At the end of each week the exams were organised to consolidate the knowledge.

Mrs. Maria Moracho from the IAEA Nuclear Installation Safety Department, evaluating this Lithuanian initiative said: “for the countries, that are preparing for new nuclear power plants, it is important to develop a nuclear safety knowledge, according to the IAEA safety standards. Lithuanian organizations and the IAEA co-operation is particularly useful in order to further develop the nuclear safety-related structures”. According to her, it was decided to organize these training courses in Lithuania, because there are experts in this field, considerable experience and is the kind of necessary training infrastructure.



*FIG. 1 Participants of IAEA Basic Professional Training Courses in Nuclear Safety in Lithuania (20-31 October 2008)*

#### 4. Lithuania in the EU – participation in EU research programmes

Lithuania's accession to the EU (1 May 2004) has opened wide horizons for co-operation. Active participation in European research programmes is very important for Lithuania since it allows Lithuania further integrate into the European Research Area, benefiting both Lithuanian researchers and country as a whole. During the last few years, a major overhaul of the Lithuanian research system has been taking place using European structural and national funding. State research institutions were consolidated to make them stronger and more visible internationally. New infrastructure and laboratories are being added, making sure Lithuanian researchers have modern instruments at their disposal. Lithuania is also renewing its research base and creating five integrated science, study and business centres, modelled on Silicon Valley, thus encouraging research and business to come together to create innovative products of high added value. The valleys are developed with a view to building up research, studies and knowledge economy clusters at international level and consolidating the long-term foundation for the competitiveness of Lithuania's economy.

The success rate of Lithuania participation in the Seventh Framework Programme is close to the EU average – it currently places Lithuania right in the middle (the success rate of Lithuania is 19.7%, while the EU average success rate is 21.6%). Thus, the Lithuania is number 15 among 27 EU member states. In today's globalised environment, advancing international co-operation between researchers in different countries is more important than ever. Research tasks can be accomplished much faster when the best minds in a particular field come together. Working on joint projects, researchers not only multiply the efforts to achieve particular results, but also develop and maintain networks, share expertise and resources and develop new ideas and solutions. Lithuania is committed to further enhancing international co-operation while implementing joint research initiatives and providing them with guidance and financial support.

As it was mentioned before, the Lithuanian Energy Institute (LEI) became one of main technical support organizations in Lithuania. LEI is very active involved in the networking activities with EU countries. LEI is the member of the following networks (see FIG. 2):

- Sustainable Nuclear Energy Technology Platform (SNETP);
- Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP);
- Nuclear Generation II & III Association (NUGENIA);
- European Technical Support Organisations Network (ETSON);
- European Nuclear Safety Training and Tutoring Institute (ENSTTI);
- Baltic Energy Security Research Platform (BESRP);
- European Network of Freshwater Research Organisations (EurAqua);
- The European Association of National Metrology Institutes (EURAMET);
- Euro-Asian cooperation of national metrological institutions (COOMET);
- New European Research Grouping on Fuel Cells and Hydrogen (N.ERGHY);
- International Energy Agency Hydrogen Implementation Agreement (IEA HIA).



FIG. 2 Main networks, where LEI is participating

## 5. Benefits after joining the networking in EU

As the example of successful networking of Lithuania in the Sixth and Seventh Framework Programme, the some success stories of LEI are presented.

### 5.1. Participation in EC FP

After joining to European Union, LEI starts actively participate in the European research programmes. Within the frame of Sixth Framework Programme LEI participated in 13 projects. Recently, in the Seventh Framework Programme there are 22 ongoing (or completed) projects, in which LEI is participating and one project is in the negotiation phase. The success rate of LEI in FP7 is approximately 35.9%. Out of 64 proposals with LEI participation, 38 passed the threshold – thus, the success rate to pass the threshold is ~59.4%.

Lithuanian Energy Institute is targeting following research themes: EURATOM; Energy; Research in Nanosciences & technologies; Information Society Technologies; Agriculture, Fisheries, Biosociety & Food; Science & Society. Below we will present in details the aspects of LEI participation in EURATOM programme.

The Success rate of Lithuania in EURATOM program is 43.6%. The requested EC contribution is 3.3 million EUR, while the obtained EC financing is 1.48 million EUR (what constitutes 44.8% of requested). The Lithuanian applicants (institutions of Research & Higher Education and Public institutions) participating in EURATOM are listed in TABLE I.

The mentioned in table LEI proposals within the frame of FP7, financed by EC, are following:

1. European Fusion Development Agreement (EURATOM-LEI)
2. Treatment and Disposal of Irradiated Graphite and Other Carbonaceous Waste (CARBOWASTE)
3. Fate of Repository Gases (FORGE)

4. Network of Excellence for a Sustainable Integration of European Research on Severe Accident Phenomenology (SARNET2)
5. MATerialsTEsting and Rules (MATTER)
6. Proposal for a harmonized European methodology for the safety assessment of innovative reactors with fast neutron spectrum planned to be built in Europe (SARGEN\_IV)
7. New MS Linking for an AdvaNced Cohesion in Euratom Research (NEWLANCER)
8. Sustainable network of Independent Technical Expertise for radioactive waste disposal (SITEX)
9. Code for European Severe Accident Management (CESAM).
10. CARbon-14 Source Term (CAST)
11. Advanced Safety Assessment: Extended PAS (ASAMPSA\_E)
12. Building a platform for enhanced societal research related to nuclear energy in Central and Eastern Europe (PLATENSO)
13. Nuclear Cogeneration Industrial Initiative – Research and Development Coordination (NC2I-R)
14. Assessment of Regional Capabilities for new reactors Development through an Integrated Approach (ARCADIA).

As it is presented from the TABLE I, LEI is the leader in EURATOM programme in Lithuania. LEI received 70% and FTMC – 27% of EU funding.

TABLE I: LITHUANIAN APPLICANTS PARTICIPATING IN EURATOM.

No	Institution	Number of proposals	Number of financed proposals
<b>Research &amp; Higher Education</b>		<b>34 (87%)</b>	<b>17 (89%)</b>
1	Lithuanian Energy Institute (LEI)	29 (74%)	14 (74%)
2	Vilnius University (VU)	1 (3%)	1 (5%)
3	Kaunas University of Technology (KTU)	2 (5%)	0
4	Center for Physical Sciences & Technology (FTMC)	2 (5%)	2 (11%)
<b>Public institutions</b>		<b>5 (13%)</b>	<b>2 (11%)</b>
5	Lithuanian Geology Survey under the Ministry of Environment (LGT)	2 (5%)	0
6	Radiation Protection Center (RSC)	2 (5%)	2 (11%)
7	State Nuclear Power Safety Inspectorate (VATESI)	1 (3%)	0

The active networking of LEI and participation in the European research programmes brings double benefits for Lithuania. Being the member of different networks (SNETP, IGD-TP, NUGENIA, ETSO and others), LEI “is feeling the pulse” of development of research programmes and possibilities for the Lithuania. These knowledge and other useful information are transmitted to the other TSOs through the activity of the Coordination Council of Technical Support Organisations of VATESI, where LEI is participating as well. Such “methodology of communication” allows to disseminate the information for the other TSOs.

## 5.2. Participation in ENSTTI activities

In 2010 LEI joined the initiative of Institute for Radiological and Nuclear Safety (IRNS) to establish the European Nuclear Safety Training and Tutoring Institute (ENSTTI). The objective of ENSTTI is to provide educational, consultation and practical services by assessing radiological and nuclear safety. ENSTTI calls on European TSO expertise to maximize the transmission of knowledge and proficiency based on practical experience and culture. The training courses, depending on the background level of participants are of two types:

- Beginners (Induction Course on Nuclear Safety – initial knowledge on nuclear safety);
- Advanced (courses oriented in deeper understanding of specific problems).

LEI, as one of the founders of ENSTTI, participated in training activities from the establishment of the ENSTTI. At the beginning LEI provides their trainers in the Induction Courses. Since 2012, when ENSTTI won the projects funded by the EC Directorate-general Development and Cooperation – Europe Aid, LEI is providing the trainers for the advanced level training courses in nuclear safety, nuclear security and radiation protection. LEI provided the lecturers for the following courses: Nuclear Fuel Cycle Safety; Probabilistic safety Assessment; Deterministic Safety Assessment; Criticality Safety and Thermal-hydraulics; Ageing and Mechanical Analysis and others.

ENSTTI is organising not only training courses but also individual tutorings. ENSTTI offers tutoring periods both for junior professionals and for those with professional experience in the nuclear field. During the tutoring period, which is tailored to each applicant’s future work, trainees work alongside an expert with safety-related responsibilities within his/her own organization. The content and duration of tutoring period are adapted to each applicant’s profile. On the September 2013 the two tutoring programs (on the analysis of processes in confinements and on the emergency preparedness) for the Belarusian specialists were organized in LEI (see FIG. 3).

Each training / tutoring course is a good school not only for the trainees and tutees, but also for the trainers / tutors, as well for the course organisers. Thus, providing the trainers and tutors LEI has several objectives: to strength and systematize the nuclear knowledge, to preserve competition in nuclear safety, to gain new ideas. The close contacts with specialists from different countries, also has very positive impact and forcing to improve the knowledge in different nuclear areas. Participation in such activities will allow to Lithuanian TSO to be ready for the construction of the new NPP.



## 6. Future networking activities and conclusions

Analyzing the success of participation in the European research programmes, we can see that the old EU Member States are leading in providing proposals for the EU research programmes. There are some contradiction between the EU-15 area countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom) and the EU newcomers – EU-13 countries (Poland, Slovenia, Slovakia, Czech Republic, Lithuania, Hungary, Latvia, Estonia, Malta, Cyprus, Croatia, Romania and Bulgaria). The analogical situation is also regarding the financing from EC – the EU-15 area countries are receiving 85,4% of funding, comparing to 4,3% of funding for the EU-13 countries. There are few reasons, explaining such situation:

- EU-15 countries are better prepared to undertake ambitious projects;
- EU-13 countries distinguishes by a lack of advanced research infrastructure;
- EU-13 countries have available much lower national funds for research.



*FIG. 3 Foreign safety experts visiting LEI laboratories*

Such situation, when the old EU Member States receives biggest part of funding for research, in reality increase the gap between research infrastructures of “old” and “new” EU Member States (contrary to the intention). The situation, when the research infrastructures is better developed in EU-15 countries is very unfavorable for the remaining EU countries. The researchers from the EU-13 countries must have possibility to make careers & educate new generations at home. Otherwise, it will be just the “brain-drain” from these EU-13 countries. The only way for new EU states to compete / cooperate on equal footing with EU-15 countries is to join forces and work together. Below are presented two examples of such regional cooperation, which were initiated during the Lithuanian Presidency of the Council of the European Union in 2013:

- BRILLIANT proposal,
- Baltic Energy Security Research Platform (BESRP).

The scientific institutions and industrial partners in Lithuania, Latvia, Estonia, Poland and Sweden decided to form a Baltic Region Initiative for the Long Lasting InnovAtive Nuclear Technologies (BRILLIANT). The main goal of BRILLIANT project is to find optimal regional solution to create cooperation platform for modern electrical power solutions. The main objective of the BRILLIANT is to identify the real barriers for nuclear power development in Baltic countries region and prepare the ground for overcoming them. The aim of the current project is to support the exchange of scientific knowledge and competences between Baltic region countries.

The Energy security is very important issue for the Baltic Sea region, which aims for full integration into the European Union's Internal Energy Market. Thus, the cooperation and facilitation of interaction among researchers, energy infrastructure operators and government bodies on energy security should be enhanced. The scientific support should be provided to the implementation of strategic projects being carried out under the framework of the Baltic Energy Market Interconnection Plan (BEMIP) and beyond. From the other hand, there is the need in indicating major tendencies and proposing scenarios from regional perspective in terms of usage of the new energy infrastructure, technological innovations and combination of different kinds of energy resources (including possible sustainable use of unconventional sources of energy, e.g. shale gas) in order to create efficient and environmentally friendly energy mix in the region and ensuring reliability of energy supply. Having in the mind the mentioned above challenges, the researches from Baltic States and Sweden decided to create the Baltic Energy Security Research Platform (BESRP). The main aim of the newly set up Platform is to strengthen the role of science in ensuring regional energy security and to provide scientific support for strategic projects, especially the BEMIP projects.

The partners, joined this platform are following:

- Lithuanian Energy Institute (LEI), Vytautas Magnus University (VMU), Kaunas University of Technology (KTU) – Lithuania
- Institute of Physical Energetics (IPE) – Latvia
- University of Tartu (UT) – Estonia
- Royal Institute of Technology - Kungliga Tekniska Högskolan (KTH) – Sweden
- Joint Research Centre Institute for Energy and Transport (IET).

Summarizing, it is necessary to point out, that Lithuania is actively participating in the European research programmes (FP6, FP7) and this is the basis for successful participation in the biggest EU Research and Innovation programme Horizon 2020. However, evaluating the differences in research infrastructures between the “old” and “new” EU Member States, there is only way for new EU states to participate on equal basis with the EU-15 countries - to join forces and work together.