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Challenges and opportunities of lifelong learning in the field of energy efficiency and new energy

The article deals with the concept of lifelong learning (LLL concept), which is used widely in the developed countries. It reflects the reasons for the concept's introduction in the field of energy efficiency and new energy in modern Russia as well as the advantages, opportunities and challenges of its adoption. The research contains the materials of foreign expeditions for the period from 2010 to 2011. The article also deals with the estimation of the legislative and regulatory basis for housing and energy-efficient policy. It is concluded that it is possible to develop the vast national potential in the field of new energy and energy efficiency by the introduction of the Life-Long Learning concept.

National potential, new energy, llifelong learning.

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The concept of lifelong learning (LLL concept) allows each individual to realize the personal potential at all ages, regardless of place, time and other circumstances: at work, at university, at school, at home and on the way home using all possible channels, means and methods [1]. The urgency of the practical implementation of the LLL concept is declared at the state level in our country now [2]. The government of Russia recognized in 2010 that lifelong education should become the foundation for the personal life success, national welfare and the country's competitiveness. This article deals with the LLL concept in new energy. New energy is a broad concept which includes the fact that is considered as the alternative energy in different sources. Researches in the field of new energy cover not only the problems of the creation and usage of innovative technologies to produce energy, but also various activities for energy conservation and energy efficiency. It is a new rapidly changing area of scientific knowledge, which lies at the junction of technical, environmental, economic and political sciences. Since the new energy is a growing sector of the economy in the developed countries, the graduates of this trend in education are in demand in the labor market. The broad concept of "new energy" does not allow us to appraise all the possibilities of lifelong education for its development in this article. We have pointed out the organization of lifelong education in North-Western Europe mainly for the development of energy services in housing to population.

During the investigation the author tried to answer the following questions: What kind of education is the lifelong learning in the field of energy efficiency and new energy (LLL foreign scheme) like? What has gone of the lifelong learning in Russia? Are there any reasons to

apply new energy in the North-West of Russia? What are the key issues of energy conservation state policy? Who can cash in the introduction of the lifelong learning in the field of new energy? What are the main challenges of the lifelong learning? What are the advantages of the European innovative educational system of in the field of new energy? What is the actual result of LLL practical application in the West (case study)? What designer developments which are successful in the field of power efficient housing and available on the modern energy services market do innovative educational system use? What is the impact of the modern Russian regulatory and legislative base? Where, when and why should we introduce lifelong learning?

The research contains the materials of the expeditions of 2010 and 2011: Centre for Alternative Technology – CAT (demonstration ground), Powys, North Wales. Energy company "Organic Power" (energy technology of methane biogas usage), Somerset, the UK Energy Service Company (public service), Stafford, the UK Biofuel boiler room (residential area heating), Alta, Norway. The University of Keele, England. The natures of these organizations' activity are very different, but all of them are related to new energy technologies, as well as they are actively involved in the educational processes of appropriate courses of the university regional centers.

Formally, the LLL concept is manifested at the state level (both abroad and in Russia) in the creation of educational systems covering people of all ages. The LLL concepts were started to be created at the governmental level in the western countries in the late 80s [3]. The domestic draft concept of lifelong education in 2011 uses the same foreign terms. However, the Russian economic system is characterized by the discrepancy between the stated policy objectives and the policy itself. Therefore, it is important to consider the type of socio-economic environment where the plan for the development of lifelong learning mechanisms, stated by the Russian government for the period until 2015, will be implemented as well as it's necessary to take into account the ways of the plan's execution.

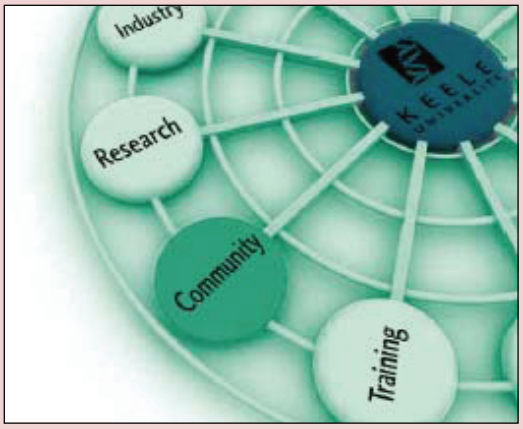
The structure of foreign educational systems can be represented in the diagram *(fig. 1)* which describes the Keele Hub for Sustainability created in Keele University. Structural organization and the real amount of financing of lifelong learning in the United Kingdom are presented in *table*.

The process of lifelong learning stimulates the active interaction between usiness, academics, teachers and community (i.e. it covers the whole population of the region).

Lifelong learning is widely distributed abroad; it goes beyond the scope of getting a degree for subsequent work. People realize themselves and their capabilities better; there are new positive connections between the people within the local communities. It makes the people and communities more flexible and strong [4].

There are substantial grounds to use widely new energy and the LLL concept in the North-West of Russia. Despite the northern geographical conditions, our country has huge potential for renewable energy development [5]. The educational systems, that focus on the development of energy-efficient technologies in housing (particularly for new housing) and transportation sectors, biofuel and tidal energy, are important for regional economic policy in the North-West of Russia, because there is a considerable potential for the development of these areas here. We can't note the Project for Building Energy Efficiency in the North West of Russia (00074315) by UNDP/GEF and the Office of Plenipotentiary Representative of the President of the Russian Federation in the North-West Federal District which was started in December, 2010[6]. The project's objective is to build local capacities and demonstrate local solutions to improved energy efficiency in construction and maintenance of buildings in the North-West of Russia.

Figure 1. The Keele Hub for Sustainability



Source: http://www.keele.ac.uk/keelehub/

Education expenditures in Great Britain, 2007 – 2008

Amount and structure of expenditures	bln. pounds sterling	%
Direct state budget expenditures for formal education and training	12.90	23.51
Direct state budget expenditures for advanced training programs	1.20	2.19
Direct state budget expenditures for the development of public employment sector	7.70	14.03
Immunity from taxation	3.70	6.74
Expenditure for the staff development within commercial organizations	16.20	29.52
The costs of self-employed people to develop their professional education	3.90	7.11
The costs of the local community and voluntary contributions in the public programs	0.63	1.15
The costs of the local community and voluntary contributions in the development of employment	3.15	5.74
Training costs of individual representatives	5.50	10.02
Total	54.88	100.00
Source: IFFL – Inquiry into the Future for Lifelong Learning.		

During the project they plan to develop and implement the training modules on energy efficiency to increase potential and improve vocational education; to establish an interregional professional development and staff retraining center at one of the universities in each of the three pilot oblasts: the Pskov, Vologda and Arkhangelsk Oblasts. The results of the project will be announced in December, 2011.

However, considering the prerequisites of the LLL concept for new energy in Russia, it is impossible to mention the major problems of the state energy conservation policy. "Despite the increasing relevance of renewable energy sources in Russia, the interest of Russian officials and business in the foreign experience in the development and implementation of renewable energy, as well as the growing desire of foreign producers to enter the Russian market with many proposals, the Russian legislative base isn't ready to adopt such concept as "renewable energy sources" [7]. This quotation from the forum ENERGY FRESH 2011 reveals a much greater number of issues than it can be seen at a glance. What exactly do western producers offer to our country? (They often export the products which are banned in their native countries). Why are the Russian governmental structures and businesses interested in the implementation of international developments?

The main beneficiary from the development of lifelong learning for energy efficiency and new energy is the state, because its energy

security is increased as a result [8], the internal social and economic sustainability is raised by the growth of human capital – the national capacity of the country. There is an original idea that "a prophet is not without honour save in his own country". So the author refers to the idea [9], where western experts, political scientists and economists note that since 2000 Russia has been trying to rehabilitate its greatness based on the military and energy security. Western observers [9] indicate that there is the third "pillar" of the modern government era in Russia. It is a political "pragmatism", which is generated by a mixture of cynicism, the spirit of profit and gross materialism. This factor in Russian politics is the main obstacle to every kind of security including the energy security and, as a consequence, it is the main challenge in implementation of the lifelong learning system.

Another challenge in the development of not only lifelong learning but also new energy in general is manifested in the fact that there is a strong lobby from the representatives of the traditional fuel energy, which are interested in squeezing out of the maximum profits from their production capacity, rather than in their early closing. The questions about the closing and extension of operation life are always brought up over the last decade. The tragedy of Fukusima in 2011 has poured oil to the fire.

In addition, our civilization is craving for energy nowadays, that's why it has to fix on fossil fuels. This fact gives rise to the global demographic changes, population growth, land and energy appetite. At the same time there is no smart solution [10]. Understanding of this fact is another (but not the last) challenge on the way to new energy and lifelong learning in this area.

The benefits of European innovative educational systems in the field of new energy are manifested in the fact that this educational area competes successfully with other areas because graduated specialists are in demand in the small businesses power enterprises that provide services to the public on the installation and maintenance of new energy facilities. Currently, there are special courses in all the training centers of the Nordic countries. They are aimed at the staff training for private energy companies serving the public. And they are not only the energy companies (for example, a local boiler house for biomass, municipal energy service company, filling station for cars on biofuel, etc.), but they include construction companies, because there is the constant toughening of requirements to the power balance of buildings under construction.

However, the innovative activity of students and teachers during specialized courses aimed at the training of specialists for further work with the new energy objects is carried out within the scope of different research projects. There are the experimental platforms that allow students to combine personal interests with diversified high-tech options for new power plants.

In addition, the innovative education systems create the programs aimed at the development of functional management structure in terms of energy production and the appropriate renewal of the content, methodology and resource support of the course. Teachers and students work in the innovation mode; they are interested in research activities. Current practice of engineering, educational and administrative tools of innovative activity change effectively the educational process for these courses.

At the same time innovative education systems form creative teams and professional methodological programs. They work in four main areas: ideological, technological, organizational and economic. Ideological area considers ergonomics, synergy, modern rationalism and humanization as the methods and techniques to update the process of decision making. Technological area deals with the innovative technologies that require radical changes in the understanding of new engineering solutions.

Organizational area forms the managerial structures which meet the requirements of lifelong sustainable development. Economic area works out the mechanisms for the development of various financing schemes including the specific practical projects and specialists' wages, as well as methodological support and material-technical base of education.

European innovative educational systems in the field of new energy grow continuously high creative potential. They work in the conditions of constant diversification of high-energy production and create the conditions for the qualitative development of professional competencies and creative abilities of students. Such innovative educational systems provide the behavior model which allows us to make the decisions in consideration of the changes in progress and working results, ensuring the sustainable development of an educational course and subsequent employment of graduates. That is, there is an obvious convergence of industrial and educational goals and their economic compatibility.

This fact is essential for the self-renewing staff of new high-tech and high-energy production and adaptation to the changing socio-economic space.

Talking about the actual result of the LLL practical application in the western countries, we should note the case study of solar panels and improved insulation properties of the walls and roofs in the house which was reconstructed from the former stables *(fig. 2)*. The owners were deep retired husband and wife which were about 80 years old. Payback period of the project was approximately 10 years. When I asked them "Why did they do that?" they responded the following story. They wanted to know what they could do in their house. So they sought advice by e-mail to their energy company. Then the specialists came and made energy auditing of their house. They received its results and recommendations to the cost of the measures and their payback periods by e-mail two weeks later. There was also a heat pump and a boiler change among the measures. The pensioners chose the solar panels and heat insulation for the walls and ceiling from a proposed list.

Figure 2. The actual result of the LLL practical application

The practical effect of the LLL concept in this case is show up in the UK residential sector primarily by the use of available information. The state encourages new energy advertising and creates the economic mechanisms which allow their residents to get comprehensive information quickly and free of charge that enable them to make all the possible decisions.

Western pragmatism recognizes that the paradigm of lifelong learning allows them to change vocational guidance and training, because in such situation supply responds quickly to demand for the professionals who are required by energy companies. Therefore, material, financial and intellectual resources are used more efficiently. As a result of the LLL concepts, there are new professionals, traditional specialists enriched with new knowledge, as well as "advanced" users of new energy services. There are blurred borders between basic and non-basic education.

It should be noted that the blurred borders phenomenon is expressed in the new terms during the creation of the LLL concept in Russia. So, there is a term "organization of lifelong learning" instead of a term "institutions of post-secondary professional training". Thereby, the sphere of post-secondary professional training was expanded by such new types of organizations as corporate universities, as well as by new forms of learning such as trainings [11]. In order to recognize the qualifications obtained through formal education and spontaneous training, they offer to create certificate authorities which will confirm that knowledge, skills and competencies of employees satisfy the qualifying requirements. The creation of such certificate authorities in Russia may become another bureaucratic "trough".

What do the participants of lifelong learning study in the field of new energy? The innovative educational systems of the developed countries use successful designer developments in the field of energy efficient housing that are available on the energy service market [12].

It is believed that heat from the sun, breathing and temperature gradient of soil can provide a stable temperature inside the building with a minimum of mechanical means. The projects on building energy efficiency use the computer three-dimensional models that show how the influx of solar energy to the building depends on the daily and seasonal position of the sun, as well as the influence of doors and windows placement, insulating properties of building materials, the efficiency of heating systems, ventilation and lighting, accommodating landscape climate. Such models help to make economic evaluation of cost and payback period of energy-saving innovations. They allow us to estimate the ecological balance of a building. Community heating and cooling system involves the use of highly efficient equipment and insulation, windows of high quality, natural ventilation and other approaches. Water heating load is reduced by a fixed water supply to the consumer (showers with buttons that give a portion of water until the next button is pressed), utilization of waste water, water heating by the sun and energy-efficient water heaters. The required lighting load in the daytime (up to 100%) can be provided by optical fibers that transmit light to different rooms (for example, basements). At night it is reasonable to use fluorescent and LED lamps, which are not heated. A variety of electrical loads can be reduced through the use of modern energy-efficient appliances and by decrease in phantom load of electrical equipment in standby mode (when the red light is waiting for a remote command from a remote control). It is now known that this phantom load amounts up to 10% of total electricity consumption in the house. For example, some buildings use the old technologies to reduce heat losses. They cover their houses with a soil layer with vegetation or insulate the walls with pressed straw blocks depending on local climate. People also use pre-assembled building blocks (wall panels, roof and landscape surface).

They utilize the heat which is thrown out in ordinary houses. For example, it is possible to use the heat of ventilation channels, hot water, combined heat and power, as well as absorption chillers (in contrast to the compressor refrigerators weed).

In the case of an individual (detached) house we can use various micro-energy technologies for electric supply and heating – solar cells, wind turbines, biofuels and solar collectors (in the appropriate season). Electrical networks help to cope with seasonal swings in consumption, as they allow us to export electricity to the network if it is in plenty and get it out the network with a shortage of its production. It is known that cost value and resources consumption efficiency increase if such buildings are combined at the local level in the house groups, districts, villages, etc. There is a loss reduction in transmission and distribution in such case. These losses are amounted to approximately 7.2 – 7.4% of the transferred energy. Topography affects the potential amount of energy. In order to eliminate the use of fossil fuels completely, it is necessary for a building's location to have geothermal resource, micro-hydro resource, solar and wind resources.

A combination of two strategies – energy saving and energy generating from renewable sources – is considered to be the most environmental solution. Since 1980 the developments of passive (energy efficient) buildings have been demonstrating that the house's heat consumption can be reduced by 70 – 90% in many locations, without the active capacity of energy production. The residents' behavior is varied by temperature and light indoors, by hot water and electrical household appliances usage and, accordingly, it greatly affects the amount of consumed energy.

That is, the concept of comfort is varied widely. For example, a study of similar houses in the U.S. with a similar set of tenants showed huge variations in power consumption; it was doubled in some cases.

These successful energy-efficient housing designs cannot be considered as available projects for mass consumers in modern Russia. Nevertheless, one can observe the emergence of a significant number of cottages and townhouses which often form the settlements of these types. If the consumer has enough money to buy or to build such house, it should be understood that the efficiency of the energy balance of the selected type of real estate will affect not only the cost of its maintenance, but the sales price. If you are going to use energy-saving equipment in your house or to connect to new energy sources, it is important to know that these technologies gave not only positive results during the years of their development. There are a lot of substandard and low-grade products in the modern Russian market of services for energy efficiency and conservation. Most of them are prohibited in those countries where they began to be used. That's why it is important to use solid and reliable domestic experience in construction.

In order to understand the current conditions for prospective participants in the process of lifelong learning in the field of new energy in Russia, it is important to consider the legislative and regulatory base of housing and energy conservation policy, because they define the environment where specialists have to carry out their professional activity and ultimate consumer has to use services including lifelong learning.

The Federal Law No. 185-FL "About Fund of Assistance to Reforming Housing and Communal Services" was adopted in June, 2007. It was extended up to 01.01.2013 by the Federal Law No. 441-FL of 29.12.2010 [13]. The objectives of the Fund are creation of safe and favorable living conditions for citizens and promotion of reforming housing and communal services, the development of the effective mechanisms for housing management, the introduction of resource-saving technologies at the expense of financial support from the Fund.

However, the 185th law is very heavily regulated; it is difficult to observe all the conditions required by the law. Besides, the Fund's money amount to a very small percentage of the real Russian requirements for the stated purpose.

The Federal Law No. 261-FL "On Energy Saving and Energy Efficiency Enhancement" was adopted in late 2009. Then the Order of the Government of the Russian Federation No. 1830-p (as amended on 22.04.2010) "On Approval of the Plan of Energy Saving and Energy Efficiency Enhancement in the Russian Federation" was adopted. The Russian Government adopted the Resolution No. 1225 "On the Requirements for Regional and Municipal Programs in Energy Saving and Energy Efficiency Enhancement" in December, 2009. That document established a list of targets (without specific numerical values!) in the field of energy saving and energy efficiency and due dates of energy saving and energy efficiency arrangements. Thus, the Federal Law No. 261 only mentioned the need to introduce energy efficiency indicators. Unfortunately, the development of indicators was deferred and entrusted with the government. And the system of indicators should be clearly defined in the law. It could become a measure of objective assessment of energy efficiency in our country [14].

The Presidential Decree of 13.05.2010 No. 579 "On the estimate of efficiency of executive authorities of Russian regions and local authorities of urban districts and municipalities in energy saving and energy efficiency enhancement" was issued in 2010. And then the Resolution of the Government of the Russian Federation 15.05.2010 No. 340 "On the procedure for establishing the requirements for the programs in energy saving and energy efficiency enhancement for the organizations engaged in regulated activities" (it was issued along with the "Regulations for the established requirements to the programs in energy saving and energy efficiency enhancement for the organizations engaged in regulated activities").

The project "Energy Efficient Quarter" is one of six projects in energy efficiency which was approved in autumn of 2009 by the results of a joint meeting of the Presidential Commission for Modernization and Technological Development of the Russian Economy and the Presidium of the Presidential Council for Science, Technology and Education. The pilot project "Energy Efficient Quarter" started practically in 2010 in four cities of Russia: Vorkuta, Kazan, Tyumen and Apatity [15].

The experience the city of Apatity showed that the project worked mainly with social infrastructure (schools, kindergartens and other municipal buildings). It was not a "quarter" for residential buildings, and point designs for the "elite" houses which were able to meet the requirements of the 185th law. There were very few such houses; they stood out against a background of other houses and caused the "bad" feelings of other people. On close acquaintance with the practical economic existence of those houses (for example, the house on Lenin Street, 14), it became clear that there was hard work by volunteer activists from those houses, who managed to unite the residents. At the same time, technical state of the building and financial opportunities of its residents were crucial.

In fact, the pilot project "Energy Efficient Quarter" could become the domestic analogous to the Western European lifelong learning. They have the same declared goals increasing the stability of local community; the same agents are involved; there is an accumulation of knowledge and experience of the population in the field of energy and resource saving. However, according to the Russian tradition, there is a clear gap between our desires and results. The bulk of the local community feels that they are shared unfairly with something. There is jealousy and other negative relationships. People feel themselves more helpless, and so the community doesn't become stronger and more stable due to the considered government's participation.

We can continue to analyze the results achieved by Apatity's pilot area, the emerging patterns of lifelong learning and develop methods of their use. But that's another topic for another article.

There are pessimistic doubts about the ability of the LLL concept to increase national potential, to improve energy security and to raise social justice in Russia. But it must be said in defense of the LLL concept that lifelong learning exists independently and permanently for everyone who is interested in it. Also there is a rule "If you are warned so you are defended". Nevertheless, we can't see the stability of the local community as a result of lifelong learning in Russian, but on the contrary, the alarms sound, they are spread around by online Internet forums. That's why we should pay attention to the western LLL concept where the government thinks its role in such a way to promote the sustainability of their local communities, giving them a sense of security and justice.

Comparing our energy policy in the housing sector with the European one, we can say that the Directive on the Energy Performance of Buildings – EPBD (it was adopted in 2002) has developed the standards for the following areas: energy certification (labeling) of a wide range of household appliances; efficiency standards of household appliances; performance characteristics of the boilers; measures to limit CO2 emissions by improving energy efficiency, energy performance of buildings [16]. However, EPBD offers only a general framework, while the EU member states have to do the main work. They should adapt these standards to specific climatic, economic, cultural and technical conditions. All of them are characterized by different levels of readiness; they will have to do a large amount of legislative work. Many of these countries have asked for extension of the EPBD implementation period which was originally installed in 2009. Due to of the differences between different approaches, EPBD was not implemented completely in Europe in 2009.

Most countries were reviewing their own energy policies in parallel with the implementation of EPBD. They identified the new initiatives for the promotion of renewable energy in buildings and for a special certification of environmentally sustainable buildings [17]. EPBD is one of the most important EU documents.

Thus, a comparative analysis of legislative and regulatory base for housing and energy saving policies has revealed a very significant inequality of the conditions for the development of the LLL concepts. It has tipped the balance against Russia, because the Russian policy leads to the gap between the country and the state. The modern LLL concept can become one of the tools to bridge this gap. It provides a positive role of the state through tax remissions and economic liberties to the participants of lifelong learning. These participants include the persons which are formally involved in basic education and training, in the advanced training programs, in the public employment sector. And they include practically all the local communities in whole. Commercial organizations and corporations provide the financing for lifelong learning of their staff. The local communities such as regional governments and municipal administrations can help to patronize lifelong learning in their territories. It is necessary to promote and encourage the volunteer movement in lifelong learning.

The old truths "people in trouble are left to themselves" and "fish rot away from the head, but you must gill it with the tail" are relevant again in Russia. So it is important for an average consumer to use lifelong learning in the field of energy efficiency and new energy right now and everywhere in Russia in order to defend themselves against the rising energy prices. It helps not only to increase energy security, but also to remove the social tensions caused by an acute sense of injustice and neglect at the significant part of population.

Educational programs graduates can work in the energy service companies which provide different energy services. Other independent students of lifelong learning programs can understand better what available services they can apply in their houses. At the same time it is necessary to build innovative systems of lifelong learning for Russian regions taking into account the best traditions of Russian and foreign educational experience, local national peculiarities and the special social significance of power engineering specialists.

The main task of lifelong learning systems in the field of energy efficiency and new energy is training of the competitive professionals who are able to satisfy the interests of stakeholders of the economic relations, as well as to adapt to the changing socio-economic space. Such education is certainly promising, because its development will not only improve internal socio-economic situation, but it can also improve the country's prestige in the international arena. Lifelong learning will open new opportunities for international exchange student programs. It will also attract foreign subsidies for the development of new energy in Russia.

Thus, the main challenges to the LLL for new energy in our country are the following: political "pragmatism" generated as a mixture of cynicism, the spirit of profit and rough materialism; frequent discrepancy between the stated policy objectives and the policy itself; unavailability of the Russian legal base to meet the emergence of new energy. In this regard, we can offer administrative structures the following advices to use LLL: it is necessary to develop state advertising of education and qualitative proposals in the field of new energy, to form a positive image of the state through tax remissions and economic liberties in the new energy sector, to promote and encourage the volunteer movement in lifelong learning. It should be noted that this work does not pretend to be exclusive and perfect. It is just one of many attempts to examine a wide range of the issues which attend the state project of the LLL concept.

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