

RECOMMENDATIONS All-Russian Scientific and Practical Conference “Approaches to Development of the National Doctrine of Engineering Education of Russia in the New Industrialization” (4 - 6 December 2012, Tomsk)

The conference is organized by the Association for Engineering Education of Russia, the Association of Technical Universities of Russia, the Association of Innovative Regions of Russia, the National Research Tomsk Polytechnic University, the National Research Moscow State Technical University named after Bauman, Administration of Tomsk Oblast, Administration of Novosibirsk Oblast, the Foundation for Assistance to Small Innovative Enterprises in Science and Technology with the support of the Chamber of Commerce of the Russian Federation, the State Duma Committee on Education, the State Duma Committee for Science and High Technology, the Federation Council Committee on Science, Education, Culture and Information Policy, the Plenipotentiary Representative of the RF President in the Siberian Federal District V.A. Tolokonskiy.

The conference attracted over 200 participants representing universities, engineering firms, industrial companies, state and federal agencies of the legislative and executive authorities.

Upon hearing reports and considering discussions and participants in the conference note that:

Transition of the economy from the lowest to the highest technological modes is determined by the level of technological culture of the society, the quality of engineering education and the state of engineering in the country.

The economic system of Russia is characterized as a mixed economy. Thus, according to academician Evgeny Kablov the share of the second technological wave in Russia remains at 10%, the third - about 30%, the fourth - 50% (mainly in the military-industrial complex and the aerospace industry), the fifth - about 10%. At the same time, the third technological wave in the U.S. economic system is - 15%, the fourth - 20% and the fifth - 60%. And the sixth technological wave already has about 5%.

Based on the results of the research conducted by the Association for Engineering Education of Russia (AEER) the current state of engineering could not be assessed as satisfactory: 28% of experts believe that engineering in Russia is in a systemic crisis, 30% - in critical condition and 27% - in a state of stagnation. These results are confirmed by the real data as well. Thus, the share of machinery, equipment and technology in the structure of Russian export, according to various estimates, ranges from 2.9% to 5% (U.S.A. - 37%, Japan - 42%).

According to the AEER experts the state of engineering is closely linked to the state of engineering education and the level of training of engineers. However, the level of training of engineers (learning outcomes) in Russia is recognized by the same experts as satisfactory or good (85% of the experts). And this is in sharp contrast with the assessment of the state of engineering in Russia (only 15% of experts believe the current state of engineering in Russia is satisfactory or good). The explanation for

this contradiction lies in the principles of non-compliance, the content and form of modern training of specialists in the field of engineering and technology (bachelors, masters, engineers) with the industry requirements, created and developed according to the laws of the market economy.

Regarding Russia's accession to the WTO the optimal way for engineering and industrial development, allowing Russia find the rightful place in the global division of labor, is the development and implementation of the new industrialization program. The importance and need in such a program was mentioned in the keynote speech of V.V. Putin at the Forum of "Business Russia" on December 21, 2011.

Since 2009 programs of industrialization have been developed and implemented in many countries of the world in accordance with their development potential. For example, in Kazakhstan – the State Program of Forced Industrial-Innovative Development, in Latvia – Program of National Industrial Policy, which main provisions will be considered at the meeting of the Latvian government at the beginning of 2013, but its goals and specific measures are incorporated into the National Development Plan for 2014–2020, etc.

New Industrialization in Russia involves the creation or upgrading of 25 million jobs for highly skilled workers by 2020 according to the presidential decree № 596 of May 7, 2012 outlining the government's long-term economic policy objectives. The decree envisages the investments in Russia will grow to 25% of the gross domestic product (GDP) by 2015 and to 27 % by 2018, increase of share of high-tech and knowledge-intensive industries in the GDP by 2018 to 1.3 times in comparison with the level of 2011, an increase in labor productivity by 2018 to 1.5 times to the level of 2011. Also, Russia should take the 50th place in the World Bank "Doing Business" rating by 2015 and 20th place by 2018, the bill says. To achieve the stated ambitious goals it is required to elaborate Complex Program of New Industrialization, including staffing issues.

In recent years Russian engineering education has faced a number of global and national challenges. Necessity of adequate and timely measures to meet these challenges requires the adoption of systemic, political and economic decisions, covering the entire education system, as well as changes in the regulatory framework.

In case the efficient steps are taken the Russian system of engineering education could meet the staffing needs of the New industrialization Program. However, the post-industrial information society requires the shift of engineering education paradigm. Its basic principles should be included in the National Doctrine for Engineering Education of Russia, which formation approaches were the subject of the conference.

Given the above, participants in the conference recommend:

1. Legislative and executive authorities of the federal and regional levels:

- To develop together with the expert community the New Industrialization Complex Program of Russia based on the Strategy for Innovative Development of the Russian Federation 2020. The Program should include main goals, system indicators, means of achieving the goals, organizational structure management, resources (financial, human structural, and others). The Program should contain development of human resources in the fields of science, education, technology and innovation. Give the program the Federal Law status. Elaboration and

implementation of such a document will allow to develop the National Doctrine of engineering education in new industrialization aimed at advanced training of professional engineers and mass training, skills upgrading and retraining of specialists in the field of engineering and technology.

- To develop Regional Road Maps of new industrialization, adopt and implement a set of measures to enhance the interest of all industrialization participants. Embody the principles of the Regional Road Maps in the regional laws. The Regional Road Maps should meet possible scientific and staff requirements.
- To encourage the participation of business community (engineering firms, industrial companies) in establishing endowment - funds of universities, training specialist in the field of engineering and technology, highly qualified engineers, generation of entrepreneurs in the field of high technology business and a society with a high level of technological culture.

2. **Federal Assembly of the Russian Federation:**

- To develop and adopt after revision the “Law on the engineering profession in Russia,” which regulates the rights and duties of engineers, system of quality assurance of training in the field of engineering and technology, including state institutional accreditation of technical, universities, professional accreditation of engineering education programs and certification of engineering qualifications.

3. **Ministry of Education and Science of the Russian Federation:**

- (With participation of relevant ministries, academic community, the business community, industry representatives) work out and expedite drafting of the “National Doctrine of engineering education of Russia in new industrialization”, defining the goal, advanced nature, methods and tools for the development and improvement of the national engineering education in the new industrialization. Introduce draft document for broad discussion by expert community and the public, for adoption to the Government of the Russian Federation and, as a bill to the State Duma of the Russian Federation.
- To make a list of directions and specialties for students in the field of engineering and technology to meet the needs of new industrialization.
- To build up an integral system for accreditation of higher education institutions, international professional accreditation of engineering educational programs and international certification of engineering qualifications, maintaining a national register of accrediting organizations and the national register of professional engineers.
- To continue efforts and significantly improve the quality of pre-school, secondary, vocational and higher education. Promote interaction and cooperation between education, business, science and government.
- To consider the introduction of a 12-year secondary education.
- To form a set of measures to stimulate the work of groups of higher education institutions to improve the quality of engineering education.
- To develop and implement a tool to stimulate targeted training for staffing the Regional Road Maps of New Industrialization.
- To develop a legal status and legal form, allowing secure association (alliance) of universities and research organizations without each agency to lose its entity.

4. Academic community, representatives of professional engineering societies:

- To take an active part in research and creative work on the formation of the of the “National Doctrine of engineering education of Russia in new industrialization” National Doctrine for Engineering Education of Russia.
- To be involved in promotion activities among the youth for to improve the image of an engineer and enhance the prestige of the engineering profession.
- To participate in the formation of a society with a high level of technological culture innovations awareness.

5. Representatives of scientific organizations, business community, engineering firms, industrial companies:

- To take part in the discussion on the formation and maintenance of the principles of the “National Doctrine of engineering education of Russia in new industrialization”.
- To contribute to developing the training requirements of modern specialists in the field of engineering and technology, engineering qualifications, professional standards.
- To support activities in forming pool of experts to participate in the procedure of professional accreditation of engineering educational programs and certification of engineering qualifications.
- To work actively together with universities to prepare up-to-date professionals in the field of engineering and technology. Provide opportunities for the training of teachers, practical training for students, taking advantage of modern facilities, founding educational laboratories at universities, creating required conditions to establish basic departments within enterprises.
- To promote the development of practice-oriented educational technology by establishing staff centers on the basis of large industrial enterprises.
- To cooperate with universities by encouraging most qualified specialists and experts to participate in the learning process.
- To create decent working conditions for engineers: the availability of modern equipment and technology, the demand and the prospect of career growth, high salary for successful graduates from engineering educational programs.

6. The heads of higher education institutions training engineers and specialists in the field of engineering and technology:

- To support participation of faculty from different universities I development and discussion the content and principles of the “National Doctrine of engineering education of Russia in new industrialization”.
- To continue efforts towards improvement the quality of engineering education and qualification level of universities’ management staff, with the use of Russian and international best practices.
- To review curriculum and educational standards within the universities in order to develop creative skills, general competence, including competence in the field of engineering entrepreneurship with the involvement of potential employers and partners from academia and engineering companies.

- To increase emphasis on the humanitarian components in the curriculum of engineering training as the basis to develop system thinking abilities of future engineers.
 - To provide in due course resources to implement Student-Centered Educational Environment corresponding the needs of postindustrial information society.
 - To develop elite engineering, creating the conditions for the formation of engineering elite, who are able to make technological breakthrough and ensure efficient implementation of the Russian new industrialization program.
 - To take active part in development of global open information environment, which allows to increase implementation of e-learning technologies in education in Russia and to close the gap with the international academic community in this area in a short time.
7. **Mass media:**
- To use efficient tools to influence public opinion to form a positive image of an engineer and engineering profession.
 - To promote the leading role of engineers in the implementation of the new industrialization program of Russia.