

One`s own turbine is closer

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Power generation and power-plant engineering will recover their old dynamics along with economic revival. Our manufacturers to maintain their share on Russian market first will have to eliminate their high-tech equipment backlog.

Large-scale modernization and energy-conservation projects, concerning power and the entire Russian economy, are directed at modern gas turbine technology development.



Photo: ITAR-TASS

According to mid-decade analyst reports, power plant engineering and electro technical companies around the world were bound to have the “dolce vita” period in their work. Although forecasts lost their shine during the crisis, experts still remain optimistic. The fact is that post-war years showed power demand steadily growing in the world, especially in the XXI century. Here are some figures that could explain marketeering experts’ optimism. According to the International Energy Agency, energy consumption increased by almost a quarter from 14.8 trillion to 19.5 trillion kWh in 2008, compared to 2003. Global consumption growth up to 26 trillion kWh is predicted by 2025. Thus, the expected average annual growth rate of installed power capacity is 2.6 percent per year up until 2025.

By that time the total installed capacity of power plants in the world is expected to increase from 3700 GWh in 2008 up to 5500 GWh in 2025. The necessary equipment for power generation, transformation and transmission is more and more in demand despite the crisis. Power engineering global market was recently literally bursting with real demand and further rise expectations. According to “Power Machines” analysts' calculations only basic equipment sales of 11 major global players in the market (Chinese manufacturers not taken into account!) have increased from less than \$ 52 billion in 2004 to more than \$ 100 billion in 2008, and the entire market (without electrician) exceeded 200 billion dollars. Moreover, according to the latest data production volumes only increased in 2009. Such is the world's power-plant engineering capacity.

Russian energy companies face grand challenges. Power capacities of 347 GW should be in operation only by the base version of General Scheme for power sector development until 2020. Together with exhausted equipment replacement, this means 186 GW of introduced capacities - a volume similar to global annual power equipment production. 25.7 km of transmission lines construction will be required only for connecting to the system of newly installed and expanding power plants.

And although it is known that target indicators of General Scheme will be changed and lowered, probably, (see "Happiness generators" [1]), nevertheless it is still obvious that energy and power-plant engineering are facing the scope of challenges estimated at least in hundreds of billion dollars. Would our power plant engineering and electro technical-industry be able to ensure such projects implementation independently? What is their position in the market, what are their future prospects and what solutions can they offer to solve the problem?

Tough job

To answer these questions, we quizzed a number of large power-plant engineering and power production companies (nuclear industry, engineering and construction companies of energy sector problems have to be discussed as a separate theme, which is not covered in this publication). The result of this survey doesn't give a complete picture of course, yet the responses of power and engineering specialists give a fairly good idea of this market situation.

Russian power equipment market structure is extremely no homogeneous, but it is clear that where Russian manufacturers of basic machinery - power and steam turbines, boilers, generators – hold a strong market position, same can't be said about electrical equipment.

Thus, according to **Andrew Aleinikov**, JSC "Power Machines" marketing and business operations director, the company holds about 80% share of domestic electrical equipment sales market.

JSC "EMAlliance" Vice President for Innovation **Boris Firsov** argues that his company's share on the Russian thermal power market can be estimated at 20-25%. According to **Boris Vainzikher**, CEO of TGC-1, all steam turbines, purchased by his company, are manufactured in Russia.

Power Machines and Ural Turbine Works machinery can easily compete with its western counterparts, as well as domestic heating boilers. **Rahmetulla Aljanov**, "RusHydro" Board Member, gives the following data: 90% of company's generators and 80% hydromechanical equipment procurement are of domestic manufacture. However, two-thirds of electronics, as well as 90% of Automated Process Control Systems are imported.

Michael Lint, Technology Director of JSC "FSK UES", Russia's largest electronics consumer, is confident that technical solutions used in his company's projects match global technological development. In matters of reactive power compensation, 220 and 500 kV voltage regulation, FSK is even ahead of foreign energy companies. FSK controlled shunt reactor have no analogues in the world. Power lines are made entirely from Russian materials and equipment. Electrical substations for voltages up to 220 kV are mostly Russian as well. Nevertheless, Michael Lint also notes that only 30% of equipment, used in construction and reconstruction of power supply facilities, are of domestic manufacture. By the end of 2012 FSK plans to increase the share of Russian equipment used of all kinds to 50%.

"Novintex" CEO Advisor **Alexander Margulyan** believes that the share of domestic companies in equipment supply can increase up to 40-50% within two to three years and up to 70% for selective types of equipment. But only in case of funding and import substitution program

effective implementation. In the meantime, its share is only 10-15% in Automated Process Control Systems, and 30-35% in relay protection and automatics equipment supply .

According to Director for Science and Innovation program of JSC “Electrozavod” **Victor Kovalev**, Russian manufacturers, competing with each other, can satisfy the energy complex transformer & reactor equipment demand starting this year.

In particular, his company's production facilities upgrade and development, including the recently launched transformer plant in Ufa, can triple in comparison to previous year the power equipment output up to 46 thousand MVA per year.

However, FSK in no hurry to narrow the suppliers' spectrum from international to only Russian ones yet. Russian companies are inferior, for example, to their Chinese colleagues on a number of positions. In particular, SF6 insulated switchgear will be installed on 220 kV "Tynda" substation in Amur region, and the possibility of using Chinese switchgear and autotransformer on a number of Southern and the North-Western power plants is being considered.

It's regrettable, that Soviet electrical engineering made pioneering inventions in technological direction such as SF6 insulated switchgear in the 80's and now this technique, mastered by our southern neighbor, returned to us in complete business solution form.

In Russia, only “Uralektrotyazhmash” announces the proximity of EHV SF6 insulated switchgear solution completion.

FSK takes the necessary steps to establish mass production of competitive domestic high voltage class SF6 insulated switchgear with All-Russia Institute of Electrical Engineering, Electromechanical plant and “Electrozavod”.

There are many weak spots. For instance, fantastic growth of wind energy notwithstanding (nearly 38.5 GW of wind capacities were installed only in 2009 all over the world, and market has exceeded 50 billion euros), it is believed that renewable energy sources (RES) will not play the same role they do for European countries, because most of the material resources and efforts will be focused on energy conservation tremendous potential and energy efficiency activities in the Russian energy generation.

However, the president of Russian Association of Wind Power Industry **Igor Bryzgunov** believes that the problem lies elsewhere: Russia still remains this market's outsider and does little to eliminate this backlog.

"We are witnessing a strange paradox: Russia, the country with the highest wind power potential in the world , has no generators production of its own, there is no wind energy project base, no adopted by-laws for tariff premiums and grid connection compensation for RES-based power generation", - says Bryzgunov. The result is well known, for example, during "RusHydro" project implementation of Far East wind power station construction on the islands of Russian and Popov only foreign companies, including Chinese, were included in the "short list" of equipment potential suppliers.

Hopes for modernization

Reserves for energy conservation and efficiency in Russian power industry are great indeed. “If new capacity introduction are still debatable over potential demand or pay-back period, the urgent need for existing facilities extensive modernization goes without saying, - announced

Boris Firsov. - Today there are no clear figures to estimate the volume of potential market, but there is no doubt about its high volume”.

JSC "Power Machines" Director for marketing and business operations shares EM Alliance top manager’s point of view. According to **Andrei Aleinikov** power engineering market is not affected by global changes and remains stable as a whole due to its nature. Decrease in one market demand is compensated by another market. Modernization and reconstruction of exhausted equipment market is actively developing during crisis.

Nevertheless, the industry situation became more complicated. "Implementation of all new investment projects was postponed to a later date – reports the Ural Turbine Works CEO **Eugene Kislitsyn.** - We're observing pent-up demand situation, and we expect demand for equipment to return after 2013-2014, not to such an extent though. Nowadays equipment modernization market becomes even more animated due to equipment depreciation and RTN (Russian Technical Supervisory Authority) stricter requirements".

Power engineering companies are obviously paying close attention to modernization market because the Russian Power Industry is simply doomed to updating extremely inefficient generating plants and decrepit power grids. All-Russian Thermal Institute (VTI) has estimated the age of 39% thermal power plants to exceed 40 years this year. According to the General Scheme 57% of TPP capacity exhaust their life-span completely, and will have to be taken out of operation in 2020 (for further details concerning energy equipment deterioration problem go to "To narrow the risk zone" [2]). Power efficiency of Russian TPP is 33% (in Japan - 45%), installed capacity utilization factor of TPP doesn't exceed 50% (in Soviet times, 67%), and it is even lower at many plants; installed capacity utilization factor of nuclear power plants is 78% (in Japan and Finland - 97%). Alas, there is no significant progress in efficiency and installed capacity utilization factor improvement of thermal and nuclear power plants in Russia, although, for example, the majority of Soviet-made nuclear power plants in Eastern Europe and Finland have been upgraded to the world's performance indicators with Russian specialists help.

According to TGC-1 CEO **Boris Vainzikher**, the authorities are prepared to encourage investments to power industry through power market development. Moreover, the adequate payment for capacity entails the interest both in new construction and modernization. Energy saving will help to expand the energy equipment market. Boris Vainzikher says: "It is no secret that the greatest potential for large-scale energy saving power technologies is available in two industries in Russia - housing and power industry. This process is directly related to gas-operating equipment modernization in energy sector, because the efficiency of CHP units is much higher than the similar of steam power plants.

Don't be ashamed to learn

CCGT (combined cycle gas turbine) unit and GT (gas turbine) unit are key abbreviations to our power engineering. Because gas dominates the fuel balance of power at the moment - about 43% of Russian power is generated with gas fuel. Gas thermal power plants modernization and steam power cycle transfer to combined heat and power, for example, by gas-turbine unit build-up could save at least a quarter of 150 billion cubic meters of gas burned today in power plant boilers, operating with 40-percent efficiency in best case while generating the same power volume.

The reason lies in far more efficient natural gas utilization in steam power units, it's always above 50% in CCGT plants and some of them even reach 58-59%. So, the most ambitious modernization and energy conservation projects lie precisely in modern gas turbine technology

development not only in power industry but also in the entire Russian economy as a whole, according to experts. Therefore, the country is in need of a national gas turbine project.

In the meantime, despite the pioneering powerful gas turbine development in Soviet period (100 MW gas turbine was installed back in 1970), Russia XXI in century is left without its own effective turbines for combined-cycle plant construction. One of the reasons for this backlog is industry science in 1990's - early 2000's was practically not working for the future, and we have a lot to catch up to and be satisfied with the student role for a while in some energy technologies. According to Andrei Aleinikov, H-class effective powerful gas turbine with 38-39% efficiency rate and over 300 MW capacity for over 600 MW CCGT plants construction with about 60% efficiency rate increasingly attract interest of generating companies. But these are no such turbines in Russia. That's why imported gas turbines - GE, Siemens, Alstom, Mitsubishi – amount to no less than 60% in the industry as showed the results of recently completed tender, says JSC "UES Engineering Center" CEO **Vladimir Jidkyi**. This is probably still one of the most vulnerable spots in terms of technological competitiveness of our power-plant engineering. And it would be impossible to breakthrough in this area, without mastering the advanced foreign experience first.

There is nothing wrong in technologies licensing, their gradual localization in cooperation with world leading manufactures and applying the experience of lessons learned for further development of our own technology, says a renowned heating engineering expert, member of the Russian Academy of Sciences Prof. **Alexander Sheindlin**: the country has gone through the same situation in 1920-1930-ies during electrification plans implementation. "But licensing, - says Prof. Sheindlin - means that corresponding large enterprises must simultaneously restore engineering and design departments with young experts recruiting, for them to gain experience and knowledge and begin to develop high-tech equipment on their own."

Our power engineering experts actively gain others` experiences through licensing technology. For example, the same EMAlliance and US-based Nooter / Eriksen signed a license agreement under which Russian companies get the right not only to assemble modern recovery boilers – they are getting the technology for hi-tech product manufacturing as well. All parts would be manufactured in Russia, and the main plant will be located on "Red boilermaker" holding-owned company in Taganrog. The agreement allows EMAlliance not only to manufacture modern equipment, but also to continue design research based on American achievements.

Vladimir Gudkov is confident that in order to develop our own advanced technologies it is necessary to solve the power-plant engineering systemic problem first. And the problem is open condition of various cycles of industry innovation development, including R&D, pilot-unit implantation, mass production and product sales to consumers with refunds to industry, and R&D in particular. And this problem should be solved on governmental level, because otherwise our power-plant engineering may lose their positions even in its own country.