Development of international cooperation in power engineering

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Abstract. The article is devoted to the consideration of the processes of development and deepening of international production and sales cooperation and specialization in power engineering. A prerequisite for this is the formation of large production groups for the production of power equipment for power plants in Russia, which are intensively expanding international production.

The current stage of development of mechanical engineering as a whole, including power engineering, is largely based on the formation and deepening of industrial specialization and cooperation between enterprises. The expansion of specialized production and mutually beneficial exchange of components and parts allows enterprises to gain competitive advantages. Along with the requirements of the organization of modern production, the objective need for the organization of production cooperation, in particular in the Russian power engineering industry, is also due to historical reasons. As a result of the political events of 1991, the country that had existed for many decades disintegrated, the links of the partner networks of many enterprises that were part of the USSR power engineering complexes turned out to be abroad. Before the collapse of the USSR, the Ministry of Energy Engineering of the USSR united more than 30 industrial enterprises. Of these, about 20, one way or another, were associated with the production of components and assemblies for nuclear energy. After the collapse of the USSR, some unique enterprises, the products of which were not produced anywhere else in the country, remained outside Russia. A significant part of the enterprises shifted to the production of other types of products. As a result, for the production of final equipment it became necessary to attract cooperation partners from the CIS countries or far abroad.

The post-Soviet period put the power engineering enterprises on the brink of survival. One of the indispensable conditions was the consolidation of business - the creation of joint stock companies uniting producers from individual industries. But the structure of the power engineering industry of the Russian Federation is fundamentally different from the current world practice. Russian enterprises are consolidating not according to the principle of creating a complex product, as in the case of leading world concerns, but according to the principle of producing components and assemblies for individual technological cycles of electricity generation. At the moment, none of the Russian power engineering companies are not able alone to complete the nuclear power unit as a whole. Thus, the conditions for broad international cooperation of enterprises of the Russian power engineering industry were objectively formed.

One of the leaders of the Russian power engineering industry, the Power Machines concern, today occupies more than half of the Russian power engineering market (its main activity is equipment for...
thermal generation) and is actively working abroad. The concern's share in the global market is about 1.5%. For the nuclear industry, Power Machines supply only part of the equipment, and not the full range of components and assemblies. The Leningrad Metal Plant and the Turbine Blade Plant mainly provide for the production of only steam-turbine power units, Elektrosila specializes in the production of high-capacity generators, and the Kaluga Turbine Plant provides the power units of the NPP with drive starting turbines. "NPO CKTI them. Polzunova ", in fact, is not a production asset - he specializes in design and research in the field of energy equipment. At his disposal are unique test stands for various purposes. Energomashkorporatsiya, which produces a fairly wide range of related equipment for the nuclear industry, includes eight significant plants, each focused on its own market segment. Among them, Uralelectrotroyazhmash OJSC (Yekaterinburg) is a manufacturer of electrical machines, powerful electrical and high-voltage equipment, the Sibenergomash PC (Barnaul) and Belgorodenergomash manufacturers of high-capacity power boilers and heat exchange equipment, and EnergomashAtommash "(Volgodonsk) - a manufacturer of gas turbines and heat exchange equipment for thermal power plants and nuclear power plants. United Machine-Building Plants (OMZ) reduced its Russian production assets to Izhora Plants and Uralmashzavod. Also at the disposal of the company are the Czech "Skoda JS" and "SkodaSteel". The company operates mainly in the nuclear engineering sector.

According to the Ministry of Energy of the Russian Federation, the total capacity of outdated equipment at power plants in Russia is 82.1 GW, (39% of installed capacity), including 57.4 GW at thermal power plants (40% of installed capacity), which indicates that it is coming 10–15 years of large-scale replacement of power equipment, which has developed its life, by commissioning high-capacity steam-power and combined-cycle plants, which, of course, makes the production of gas turbines in demand in the medium and long term willow.

It is worth noting that by 2020 already 57% of the capacity of existing thermal power plants will work out their resource. According to the forecasts of the Ministry of Energy of the Russian Federation [1], by this period, taking into account the technical re-equipment, it is planned to decommission outdated equipment of 51.7 GW of currently installed capacity.

### Table 1. The main domestic manufacturers of power equipment

| Products                  | Manufacturing companies       | Owner                    |
|---------------------------|-------------------------------|--------------------------|
| Steam turbines            | PJSC "Leningrad Metal Plant"  | PJSC Power Machines      |
|                           | PJSC "Ural Turbine Plant"     | Renova Group             |
|                           | PJSC "Kaluga Turbine Plant"   | PJSC Power Machines      |
| Gas turbine               | PJSC "Leningrad Metal Plant"  | PJSC Power Machines      |
|                           | PJSC "Saturn-gas turbines"    | JSC "UEC"                |
|                           | NAO "Nevsky Plant"            | Gazprom"                 |
| Steam boilers, waste      | PJSC "Leningrad Metal Plant"  | PJSC Power Machines      |
| heat boilers              | TKZ Krasny Kotelshchik OJSC   | PJSC Power Machines      |
|                           | JSC ZIO-Podolsk               | REMCO Group              |
| Hydraulic turbines        | PJSC "Leningrad Metal Plant"  | PJSC Power Machines      |

The choice of this area as one of the key ones for the analysis is not accidental, since the share of power plants operating on natural gas is about 50% of the installed capacity in the country (about 100 GW). The basis of the power engineering industry are the following companies: OJSC Power Machines, OJSC EMAlliance, OJSC Saturn - Gas Turbines, OJSC Atomenergomash. The peculiarity of the Russian machine-building industry is the localization of the manufacture of elements of the main power
equipment at several enterprises and in the absence of a holding company able to offer a comprehensive solution for the supply of main power equipment for the needs of thermal power plants.

Today, there is not a single domestic company among the world's largest manufacturers of generating equipment.

According to Nomura Research [2], the top ten largest manufacturers of generating equipment (steam/gas turbines) include two European companies (Siemens, Alstom), three Japanese (Toshiba, MHI, Hitachi), one American (GE), one Indian (BHEL) and three Chinese (Shanghai Turbine, Dongfang, Harbin). According to the Federal State Statistics Service [5], Russian companies annually produce turbines with an aggregate capacity of about 7–8 GW, which in terms of US dollars is 1.5–1.8 billion, while the revenues of world leaders (GE, Alstom, Siemens) from the sale of such equipment is in the range of 12 to 25 billion dollars. USA. The formerly advanced Leningrad Metal Works (LMZ, part of Power Machines OJSC) over the past 20 years has given up its share of the power equipment market to Chinese generating equipment manufacturers. Thus, in the production of steam turbines, the company's share declined from 8–9% in 1981–1990, up to 1-2% in the 2000.

It is important to understand that, unlike, for example, the French company Alstom, which offers a full range of power equipment for the construction of power facilities on a turnkey basis (EPC - Engineering, Procurement, Construction), Power Machines OJSC produces a limited range of power engineering products.

According to the Ministry of Energy of the Russian Federation, at present the world market for power engineering is estimated at $ 70 billion a year, and in the long term by 2025 its annual volume may reach $ 100–110 billion (at current prices).

The largest players in the market are Siemens, Alstom, General Electric, Mitsubishi Heavy Industries, Ansaldo and others (Fig. 1).

In recent years, foreign manufacturers began to be active in the Russian market, as well as in the traditional for Russia markets of power engineering - in the CIS countries and the Asian region. At the same time, they use all possible methods to oust Russian producers, in particular, dumping prices and consumer loans on favorable terms.

![Figure 1. The largest players in the market of power engineering](image)

The states whose residents are the leaders of the world mechanical engineering actively support the expansion of the largest companies to foreign markets. Recently, the industry has become particularly pronounced tendency to consolidate assets: among the large power engineering corporations undergo
mergers and acquisitions, which should result in more efficient financing of R & D and the emergence of companies capable of supplying the entire product line. As a result of two such mergers, for example, Alstom with ABB and Siemens with Westinghouse, branch conglomerates appeared.

Such steps by Western companies pose threats to the Russian power engineering industry. Before the mergers, our companies took part in international tenders for the supply, installation and maintenance of power equipment, performing part of the work in them, but today foreign manufacturers have all the possibilities for independent execution of the entire contract without creating a consortium with Russian contractors. In many ways, this situation is due to the lack of state support, as well as the presence of competition between Russian manufacturers of power equipment (having the ability and desire to work independently in foreign markets) and engineering companies willing to carry out the construction of power facilities "turnkey".

One of the promising ways of development of the industry is the creation of strategic partnerships with leading players in the power engineering market in order to attract not only investments, but also technologies to Russia. It should be noted that after the consolidation of specialized power engineering enterprises of heavy industry and the creation of the Power Machines concern in 2000, the German company Siemens acquired a blocking stake in it (25% - Siemens, 70% - A. Mordashov through affiliates). As part of a further partnership, in 2003 OJSC Power Machines purchased from its shareholder a license to manufacture gas turbines of the V94.2 series (GTE-160, class E) with a capacity of 160 MW. Despite the fact that this type of turbine has been in demand in the market since the late 1980s, this technology still cannot be called modern and economical. This series of turbines is not technologically advanced and actually lags behind the latest developments in technical and economic indicators. Obviously, in the early 2000s. the government had a choice to develop its own technologies, acquire a license from a large western manufacturer, create a joint venture with such an enterprise for the development of new production or transfer control over power engineering assets to a strategic partner for further modernization of production. The decision was made in favor of acquiring a license for the equipment of the German concern.

Table 2. Strategic partnerships in Russia

| Company                        | Head structure | Beneficiary | Partner          | Subject of agreement                      |
|--------------------------------|----------------|-------------|------------------|-------------------------------------------|
| Atomenergomash                 | Rosatom        | state       | Alstom           | Powerful steam turbines for nuclear power plants |
| JSC "Leningrad Metal Plant"    | OJSC Power Machines | Siemens - 25%, A. Mordashov - 70% | Siemens | Production of high power gas turbines |
| OJSC "Ural Turbine Plant"      | GC Renova      | V. Veksberg | MHI              | Production of steam and gas turbines of high power |
| JSC RusHydro                   | -              | state       | Alstom Power     | Hydropower equipment for small hydropower plants |
| JSC RusHydro                   | -              | state       | Volth Hydro      | Low and medium power turbines |

In the future, in order to increase the competitiveness of Russian power equipment on foreign markets, it seems most logical to create on the basis of large Russian industrial, construction and engineering enterprises OJSC Power Machines, OJSC EMAlliance, OJSC ZiO-Podolsk, OJSC Saturn - gas turbines, NPO Elsib OJSC, Technopromexport OJSC, Zarubezhstroy OJSC, and other national production and engineering companies, which will significantly increase the competitiveness of commercial proposals, establish effective client-contractor relations and avoid duplication of functions of manufacturers and general contractors for the construction of turnkey power plants. It is about
creating an analogue of the French company Alstom, which offers the client integrated solutions using its own production of energy equipment, which allows the company to receive additional price advantages (synergistic effect) and to retain a significant market share. By decision is meant not only the possibility of building a power plant on a turnkey basis, but also a comprehensive long-term service.

In accordance with the conducted analysis, it is possible to state different levels of development in the member states of this industry, and accordingly, different plans for the development of the industry, while increasing energy security and efficient use of resources of the power sector of the parties is relevant for all countries.

In this regard, the adoption of new technologies and the development of promising energy equipment, using public-private partnership mechanisms and with mandatory interaction with the parties' electric power industry subjects, is becoming an urgent measure for the joint development of power engineering industry, increasing the efficiency of the use of the power complexes of the Parties.

For the intensification of industrial cooperation and development of the industry it is necessary:
- Develop a mechanism for intra-industry cooperation, a common strategy for the development of the industry and create a unified information system for closer cooperation of producers;
- To create conditions for expanding the practice of mutual investments, which will contribute to the development of new industries, expanding the length of value chains;
- Develop an effective mechanism for extrabudgetary financing of the industry. In the practice of developed countries for technological innovation development of industry, including power engineering, large long-term investments are made using modern credit technologies, such as long-term investment loans, project loans (project financing), syndicated loans, as well as various forms of loans, such as bond loans. .

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