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RF MARKET OF ENGINEERING SERVICES: CONSTRUCTION AND DESIGN OF ELECTRIC GRID FACILITIES

Analytical review

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Moscow, 2011

ANNOTATION

This review is dedicated to analysis of the Russian market of construction and design of electric grids.

A separate section of the research is dedicated to the description of the Unified National Electric Grid (UNEG), analysis of initial conditions, existing problems of its operation and development. This section contains data on total length of Russian grids, number of substations, total operational staff size, data on depreciation level of the grids and other general data as well as the problems of the Russian electric grid. The execution of the investment program within the period 2008-2010 is analyzed as well.

The review gives Russian UNEG development plans for the period until 2016, plans of construction of new electric grid facilities through to 2016, forecasts of construction of UES grids by regions through to 2030. The research report analyses advanced technologies and new equipment in the field of electric grid construction, analyses possibilities of electric grid construction improvement and ways to improve efficiency of electric grid construction.

The research report contains data on planned commissioning of capacities and aerial lines in 2010 -2014 by bulk systems, data on investment volumes. Key figures of OJSC FGC UES investment program for 2010-2014 are given, FGC UES need for works, materials and equipment for various classes of works and equipment in 2010-2012 is estimated.

A separate chapter of the review describes the distribution grids development plans. This chapter contains data on restructuring of the distribution grid complex, target configuration of IDGC-RGC, main operating results of the distribution grid complex. The research contains data on investment activity of every IDGC in 2006-2010, strategic goals of IDGC-RGC development for 2008-2015.

The research report reviews the current situation, events and plans in the field of electrical grid construction. For each region new data on the most promising objects of distribution and bulk grid construction, on prospects of electrical grid construction in each region are given.

Based on the given data the review analyses the degree of growth of demand for services of enterprises engaged in construction and design of electrical grids and substations, prospects of their activities.

The research report compares energy constructing companies and design institutes on the basis of analysis of their performance indicators in 2010 and forecasts for 2011-2012. The review analysis the amounts of work of energy constructing companies in the field of construction of aerial lines, substations and cable lines, gives data on staff size, compliance with the scheduled dates of commissioning of facilities.

The research was made in July-September of 2011.

The report is on 90 pages.

The report contains 12 tables and 37 graphs and diagrams.

The report is written in English.

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ANALYSIS OF THE DEGREE OF GROWTH OF DEMAND FOR SERVICES OF ENTERPRISES ENGAGED IN CONSTRUCTION AND DESIGN OF ELECTRIC GRIDS AND SUBSTATIONS

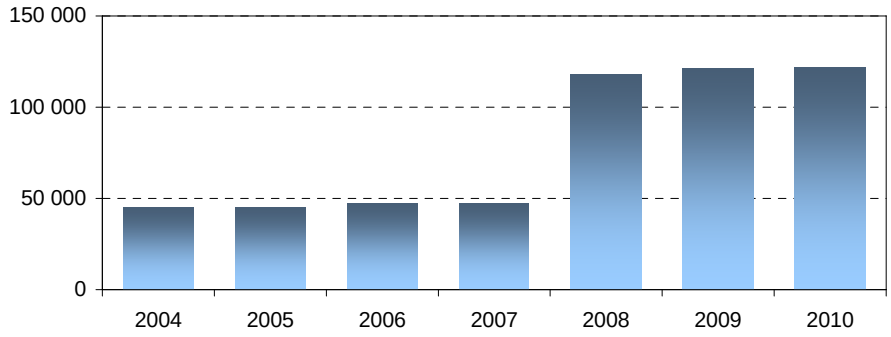
Analysis of the current state of the Unified National Electric Grid (UNEG) and possibilities of improvement of electric grid construction

The Unified National (All-Russian) Electric Grid (UNEG of Russia) is a part of the UES of Russia and is a complex of electric grids and other power grid facilities, ensuring sustainable electric supply to consumers, wholesale market operation as well as parallel operation of the Russian electric power system and electric power systems of foreign countries.

Power grid facilities of the Russian Federation are characterized by the following data.

… the total length of power transmission lines makes up … thsd. km (of which OJSC FGC UES owns … thsd. km and … thsd. km are leased).

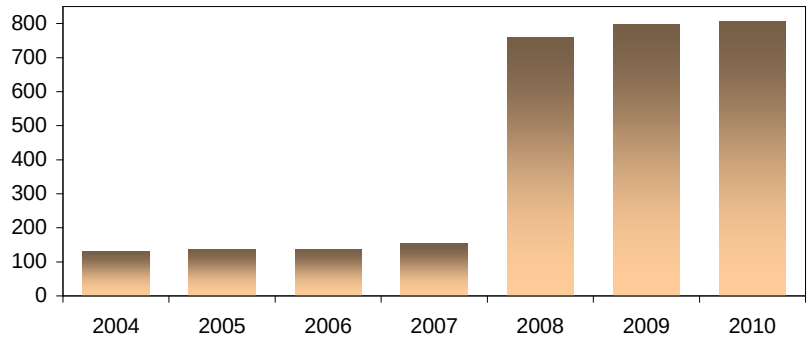
Fig. 1. Length of power transmission lines operated by OJSC FGC UES, 2004-2010, km



Source: OJSC FGC UES, 2011

Total number of substations is … with a total transformer capacity of … thsd. MVA (of which OJSC FGC UES owns … substations with a total installed transformer capacity of … thsd. MVA, other substations are leased).

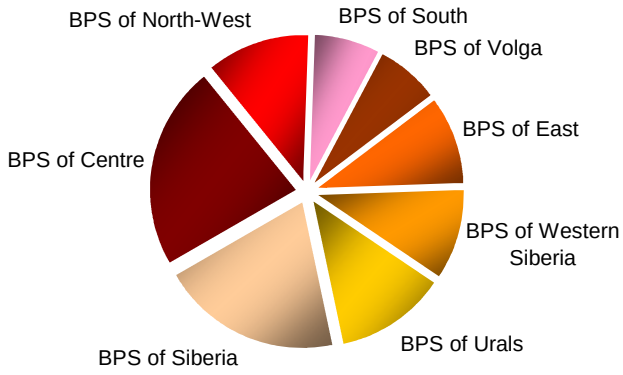
Fig. 2. Number of substations operated by OJSC FGC UES, 2004-2010, units



Source: OJSC FGC UES, 2011

The maximal length of power transmission lines is in the Central region of Russia, operated by Bulk Power Systems of Centre (BPS of Centre) – … thsd. km.

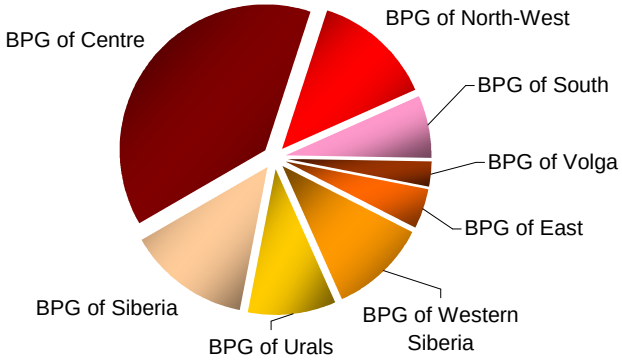
Fig. 3. Length of power transmission lines broken down by Bulk Power Systems, 2010, %



Source: OJSC FGC UES, 2010

One third of total volume of installed transformer capacity is concentrated here also.

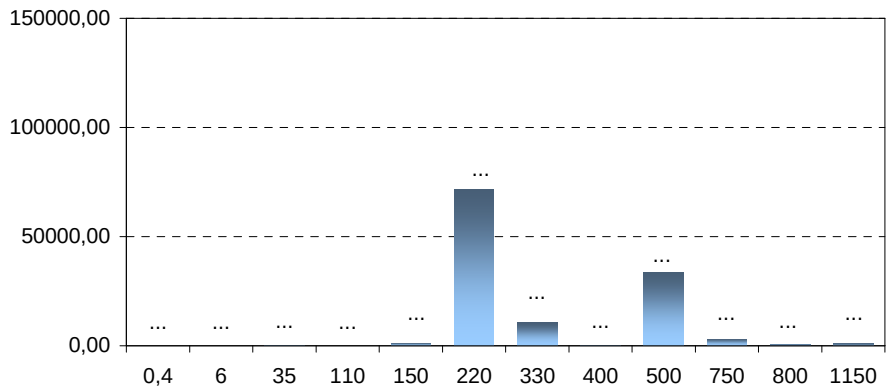
Fig. 4. Amount of installed transformer capacity broken down by Bulk Power Systems, 2010, %



Source: OJSC FGC UES, 2010

As to voltage classes, 220 kV power transmission lines are dominant in UNEG. They account for 59% of total length of power transmission lines. 500 kV power transmission lines account for 28%.

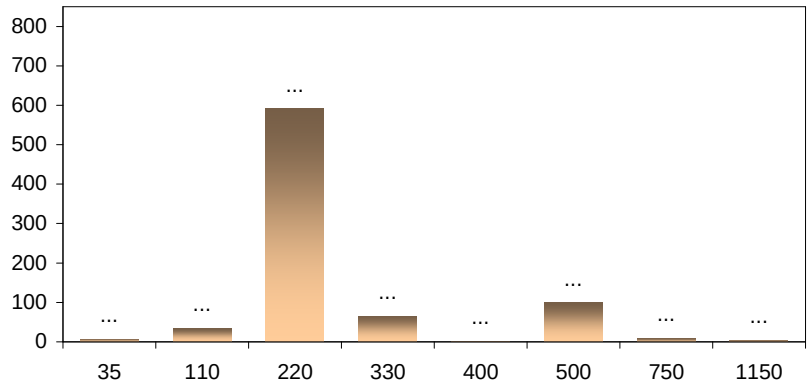
Fig. 5. Length of power transmission lines operated by OJSC FGC UES, broken down by voltage classes as of 31.12.2010, km



Source: OJSC FGC UES, 2011

Transformer capacity of 220 kV substations makes up …% of total installed capacity. 500 kV substations account for …%.

Fig. 6. Number of substations operated by OJSC FGC UES, broken down by voltage classes as of 31.12.2010, units



Source: OJSC FGC UES, 2011

The average depreciation of power grid facilities of UNEG makes up …%, in particular, that of the substation equipment — …%, power transmission lines - …%, buildings and structures — …%. In some regions of Russia there is a problem regarding insufficient transfer capacity of intersystem and backbone electric grids. The length of power transmission lines whose service life exceeds 30 years in Russia exceeds …%. The regions with high rates of growth of gross regional product, such as … have the greatest problems regarding power supply reliability and possibility of connection of new consumers.

Fig. 7. Age structure of power transmission lines

…

Source: OJSC FGC UES, 2011

Рис. 8. Возрастная структура оборудования подстанций

…

Источник: ОАО «ФСК ЕЭС», 2011г.

The analysis of age structure of the equipment installed at FGC UES facilities showed that …

…

Strategic goals and targets of UNEG development through to 2016

…

UNEG development trends for the period 2010-2016

…

Table 1. Key figures of the Program of Development of UES of Russia for the period 2010-2016 in the context of Interconnected Power Systems (IPS) and UES of Russia

IPS of Russia	km	MVA	MVAr
IPS of East, in particular			
220 kV			
500 kV			
IPS of Siberia, in particular			
220 kV			
500 kV			
IPS of North-West, in particular			
220 kV			
330 kV			
750 kV			
IPS of Mid-Volga, in particular			
220 kV			
500 kV			
IPS of South, in particular			
220 kV			
330 kV			
500 kV			
IPS of Urals, in particular			
220 kV			
500 kV			
IPS of Centre, in particular			
220 kV			
330 kV			
500 kV			
750 kV			
TOTAL, in particular			
220 kV			
330 kV			
500 kV			
750 kV			

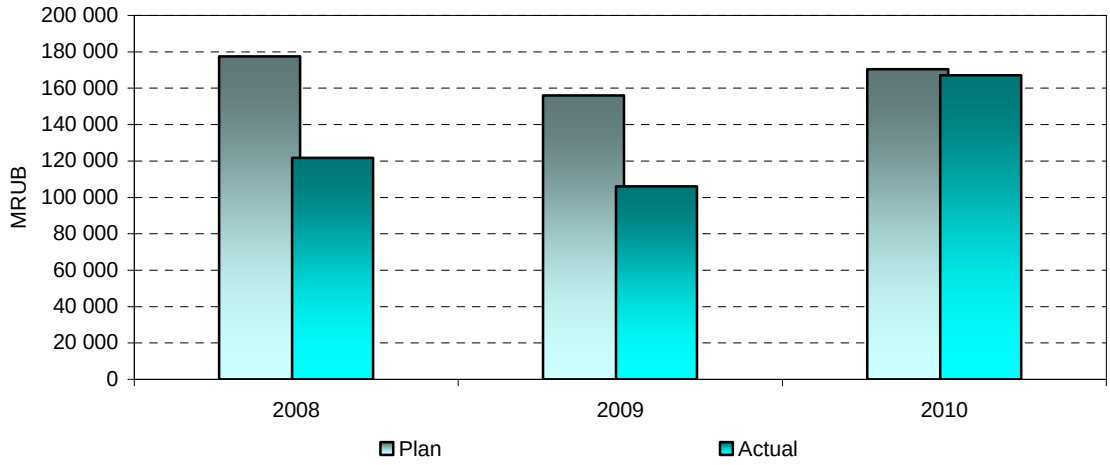
Source: OJSC FGC UES, 2011

Execution of the investment program within the period 2008-2010

…

In 2009 the investment program was executed for …%, what is below the 2008 figure by … percentage points. The investment program execution in 2010 made up …%, and in the first six months of 2011 – about …%.

Fig. 9. Amount of planned and actual financing of investments, 2008-2010



Source: OJSC FGC UES, 2011

…

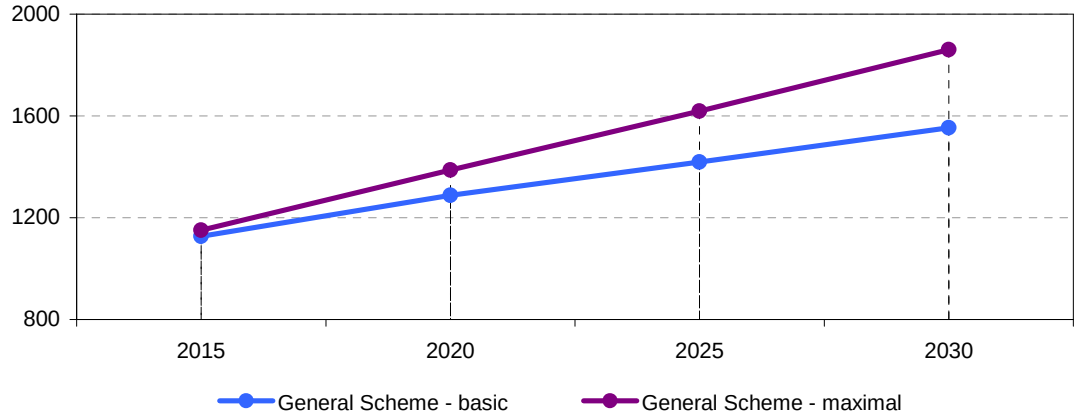
Forecasts in the field of electric grid construction (FGC, IDGC)

Forecasts of UNEG of Russia development in accordance with the Unified National Electric Grid Development Strategy and General Layout for the Power Industry Facilities

The principal condition of sound competitive interactions at the electric energy market on the part of electric grids is minimization of technical restrictions, resulting in reduction of electric energy purchase (sale) volumes against the possible volumes offered by sellers of buyers or forced electric energy market price correction owing to restricted freedom of proposals.

Prospective development of AC electric grid of UES and IPS of Russia is based on the scale of nominal voltages 110 – 220 – 500 – 1150 kV, accepted in most regions of Russia. In the North-Western region and also partly in the Central region and North Caucasus the scale of nominal voltages 110 (150) – 330 – 750 kV is used. The schema is developed in such a way that minimizes the number of additional transformations 220/330, 330/500, 500/750 kV in areas where these classes of voltage are used simultaneously.

Fig. 10. Long-term forecasts of electricity demand in Russia, 2015-2030, bln. kWh



Source: General Layout for the Power Industry Facilities up to 2030

…

Construction of UES grids of 220 kV and higher by 2030 compared to 2008 will change considerably distribution shares by regions: share increase in Far Eastern (+…), North-Western (+…), Southern (+…) and share reduction in Central (-…), Urals (-…), Volga (-…), Siberian (-…) regions.

Table 2. Construction of UES grids of 220 kV and higher broken down by regions (length forecast until 2030), thsd. km

	2008		2030	
	thsd. km	*%*	*thsd. km*	*%*
Total for RF				
Siberian FD				
Urals FD				
Far Eastern FD				
Central FD				
Southern FD				
North-Western FD				
Volga FD				

Source: RBC. research calculations (RBC Department of Consulting)

Fig. 11. Evolution of UNEG grids of 220 kV and higher broken down by regions (length in thsd. km)*

…

Source: General Layout for the Power Industry Facilities up to 2030

…

- It's necessary to commission … thsd. km of aerial lines of 330 kV and higher until 2020;
- Within the period 2010-2020 it's necessary to commission … thsd. km of aerial lines of 330 kV and higher for power delivery of new system-wide stations;
- Within the period 2010-2020 it's necessary to commission … thsd. km of aerial lines of … kV and higher to strengthen intersystem and state-to-state connections and increase reliability of electricity supply to consumers.

…

Forecasts in the field of construction of bulk electric systems and the investment program of FGC for 2010-2014

...

Table3. Key figures of OJSC FGC UES investment program for 2010-2014, MRUB

Investment pattern	2010	2011	2012	2013	2014	Total for 2010-2014
Total for OJSC FGC UES investment program for 2010-2014						
1. Technical upgrade and reconstruction						
1.1. NPP, HPP and TPP power delivery facilities						
1.2. Facilities to increase reliability of electricity supply in Moscow, St.-Petersburg and Tyumen						
1.3. Facilities, included into the Agreements with regional administrations (except Moscow, St.-Petersburg and Tyumen)						
1.4. Development of bulk systems, not included into the Agreements						
1.5. Technological connection facilities						
1.6 Program of renewal of fixed assets of OJSC FGC UES (turnaround facilities)						
1.7 Program of renewal of fixed assets of OJSC FGC UES for 2010 (facilities of simple reconstruction)						
2. New construction						
2.1. NPP, HPP and TPP power delivery facilities						
2.2. Facilities of increase of reliability of electricity supply in Moscow, St.-Petersburg and Tyumen						
2.3. Facilities, included into the Agreements with regional administrations (except Moscow, St.-Petersburg and Tyumen)						
2.4. Development of bulk systems, not included into the Agreements						
2.5. Process management development, computerization, additional target programs						
2.6. Facilities, included into the FTP “Economic and Social Development of the Far East and Transbaikal for the period until 2013”						

2.7. Program of electric grids development in Sochi region for the period 2008-2014, supporting operation of venues	
2.8. Acquisition of facilities for production purposes	
2.9. Innovations and energy efficiency	
2.10. Other	
2.11. Technological connection facilities, not included into other sections of the investment program	
2.12. Design and survey works (for years to come)	

Source: OJSC FGC UES

…

During the period 2007 – 2015 the following is planned:

1. Use of indoor gas-insulated 110–500 kV substations using factory-assembled equipment, such as SF6 insulated switchgear/control gear, PASS, and compact outdoor substations on the basis of modules, such as COMPACT, KOMBAIN and modular integrated transformer substations in central districts of megacities in restrained urban conditions.
2. Deep cable inlets 220-330-500 kV (cross-linked polyethylene).
3. Dry-type transformers.
4. Compact aerial lines on the basis of multi-sided tower bodies, isolated and high temperature wires, polymer insulators of new generation.
5. …

…

Table4. OJSC FGC UES need for equipment in 2010-2012

Equipment	Measurement unit	2010	2011	2012	Total
Power transformers, shunt reactors					
Circuit breaker 750-110 kV					
Disconnectors 750-110 kV					
Current transformers 750-110 kV					
Voltage transformers 750-110 kV					
Excess-voltage suppressors 750-110 kV					
SF6 insulated switchgear/control gear 110-500 kV					

Secondary equipment (relay protection and automatic equipment, emergency control systems, automated process control systems, automatic systems for commercial accounting of power consumption, communication, etc.)	
Power cable 110-500 kV.	

Source: OJSC FGC UES

…

Breakdown of funds of OJSC FGC UES investment program by types of facilities is as follows:

- High voltage power transmission lines – …
- Substations – …
- Infrastructure projects (digital communication, automatic systems for commercial accounting of power consumption, etc.) – …
- Cable lines – …

…

Resource limitations in the field of electric grid construction

The energy construction market structure has a number of historically formed skewnesses, that do not correspond to the needs of grid companies:

…

There are the following limitations in the design area in Russia:

…

Ways to solve the problem of resource limitations

…

Distribution grids construction forecasts and IDGC investment activities through to 2015

…

Prioritization of the state energy police

…

The priority goals in the sphere of electric grid facilities development will be as follows:

- audit of electric grid complex and creation of distribution electric grids monitoring system from the point of view of reliability and sufficient transfer capacity provision;
- modernization and technical upgrade of electric grids on the base of new electric grid technologies ensuring their reliable and efficient operation and state-of-the-art equipment corresponding to the level of the best foreign analogs;
- configuration optimization and increase of reliability of backbone and distribution electric grids for the purpose of enhancement of operation efficiency of the Unified Energy System of Russia.

The Unified Energy System of Russia will be developed both by means of integration of isolated power pool systems and power pool systems with weak electric connections and by means of development of intersystem and intrasystem electric grids of all voltage classes, including those for electricity export.

…

The following priority scientific – technological progress directions in the energy sector may be singled out:

- creation of gas turbine installations with a capacity of 300 - 350 MW and on their basis highly effective natural gas-fired condensation combined cycle gas turbine installations with a capacity of 500 – 1000 MW and a performance index exceeding 60%;
- creation of standard modular combined cycle co-generation units with a capacity of 100 and 170 MW and a performance index amounting to 53—55% for central heat and power plants;
- creation of environmentally friendly coal condensation power generating units for ultra supercritical steam conditions with a performance index of 43-46% and a capacity of 660-800 MW;
- …

…

Conclusions

The existing condition of UES of Russia and grids is as follows:

- technical base is worn out and outdated;
- high risks of loss of reliable and qualitative power supply;
- decrease in efficient performance of UES of Russia;
- management tools do not correspond to up-to-date requirements for management of large systems;
- insufficiency and absence of clear system ideology of utilization of new technological solutions in grids;
- introduction lag of up-to-date management tools and systems, their provision with information necessary for operative real-time management.

Thus the condition of electric grid facilities of Russia cannot be called satisfactory, the depreciation makes up 60-70%. This situation creates a risk of man-made disasters and threatens the stability of energy supply of the entire regions of the country. The construction of new electric grid facilities and asset renewal are necessary also for delivery of power of constructed power generation units, liquidation of “blocked” capacities and strengthening of intersystem and state-to state connections.

At present active realization of OJSC FGC UES investment program is going on in the country. New facilities (substations and aerial lines) are constructed and commissioned. Old facilities are actively upgraded. The demand for services of engineering companies in the sphere of electric power industry has a steady annual growth. This trend of increase **in construction volumes** will be preserved **at least till the end of 2014**. After 2014 the situation will depend on national measures.

The growth of demand for services of electric grid construction will be based on …

…

REVIEW OF EVENTS AND PLANS IN THE FIELD OF CONSTRUCTION OF ELECTRIC GRIDS IN REGIONS OF RUSSIA, IDGC AND BPS NEWS

Moscow and Moscow region

Current situation in the field of grid facilities

...

Implementation of new technologies in the Moscow electric grids

...

Investment programs of development of electric grid facilities of Moscow and the Moscow region. OJSC Moscow United Electric Grid Company and its investment activities

...

St. Petersburg

...

Centre

North-West

South

Siberia

Urals

East

...

Analysis of development prospects of electric grid facilities and capabilities of energy constructing companies for 2011-2015. Principal events that may affect market development

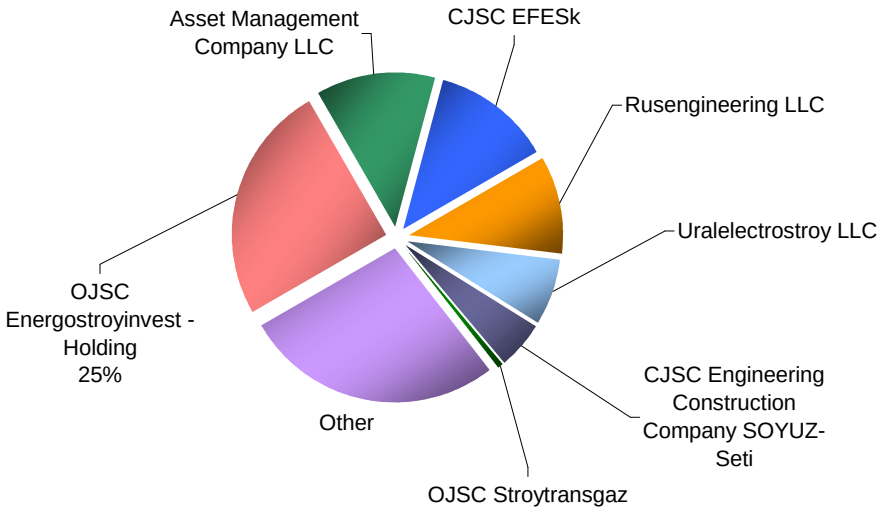
...

ANALYSIS OF PERFORMANCE INDICATORS OF ENERGY CONSTRUCTING COMPANIES IN 2010 AND FORECAST FOR 2011-2012

At present there are large energy constructing companies in Russia, that can erect turnkey electric grid facilities and work in various regions of Russia. The following companies may be singled out as such: OJSC Energostroyinvest-Holding, CJSC EFESk (Economic Financial Energy Construction Corporation), CJSC Engineering Construction Company SOYUZ-Seti, OJSC Stroytransgaz, Rusengineering LLC, Asset Management Company LLC, Uralelectrostroy LLC, OJSC GlobalElectroService, Velesstroy LLC. These companies execute large amounts of work in the field of aerial lines and substations construction for various customers. The diagrams, reflecting performance indicators of these companies, are given below. It's important to note, that OJSC GlobalElectroService and Velesstroy LLC did not participate in the analysis, but according to expert assessments, they occupy a considerable market share.

Construction volumes

Fig. 12. Work shares of major energy constructing companies in total volume of construction of aerial lines in Russia, 2010, %

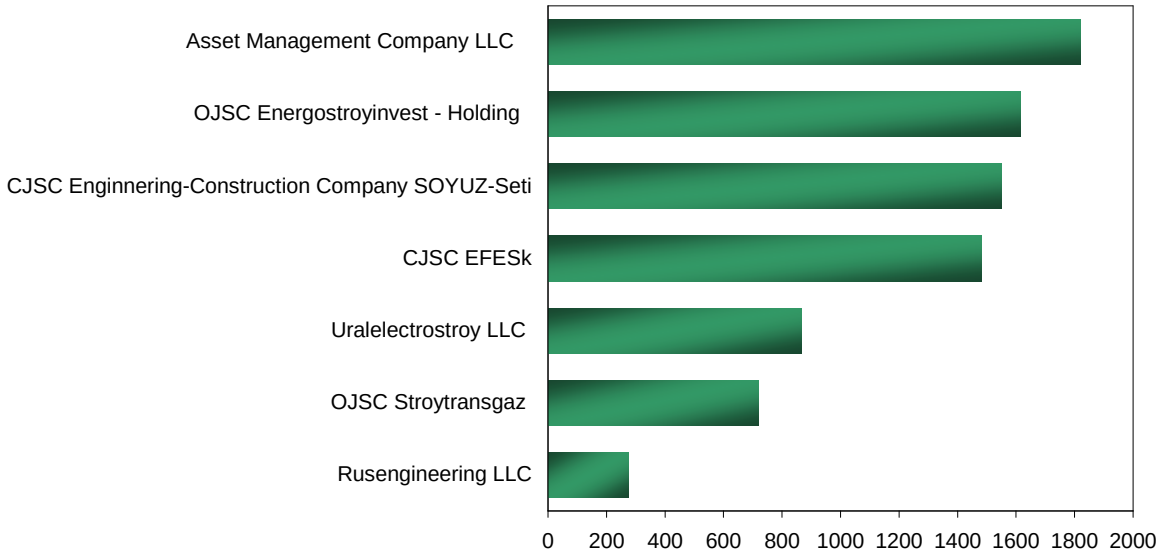


Source: calculations of RBC.research (RBC Department of Consulting), 2011

** GlobalElectroService and Velesstroy LLC did not participate in the analysis.*

As is seen from the Fig., OJSC Energostroyinvest-Holding stands first among the above companies. In 2010 its share made up …% of total volume of construction of aerial lines in Russia in the relevant period. Asset Management Company and EFESk share the second and third positions having the equal share of …% of total volume of works in the area of construction of aerial lines in Russia in 2010.

Fig. 13. Planned volumes of construction of aerial lines by major energy constructing companies in 2011-2012, km



Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

According to forecasts of energy constructing companies, Asset Management Company LLC is supposed to increase volumes of construction of aerial lines in 2011-2012 and will come out on top, thus leaving behind the 2010 leader - OJSC Energostroyinvest-Holding. Engineering Construction Company SOYUZ-Seti and EFESk will be behind by a finger's breadth.

Fig. 14. Volumes of construction of electric substations by major energy constructing companies in 2010, MVA

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

As to electric substations, … were the three largest energy constructing companies in 2010.

Fig. 15. Planned volumes of construction of electric substations by major energy constructing companies in 2011-2012, MVA

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011.

According to forecast data it is expected that in 2011-2012 … will keep its leadership and … and … will not only strengthen their positions but improve them as well and will take the second and the third places respectively.

Fig. 16. Length of cable lines laid by major energy constructing companies in 2010, km

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

Fig. 17. Forecasted length of cable lines to be laid by major energy constructing companies in 2011-2012, km

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011.

… established itself as the leading cable line constructor and, according to forecasts, will keep its leadership till 2012. … and … also were among the three leading cable line constructors in 2010. In 2011-2012 … will slash cable line construction volumes and will yield its leading positions to CJSC EFESk and Asset Management Company LLC.

Construction of aerial lines for FGC UES

Fig. 18. Planned volumes of construction of aerial lines for branches of OJSC FGC UES by major energy constructing companies in 2011-2012, km

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

In 2011-2012 … plans to construct most aerial lines for OJSC FGC UES. Siberia, Western Siberia, Urals and South are priority regions for the company.

… will also become one of the leading aerial line constructors for branches of OJSC FGC UES. The Company plans to construct considerable volumes of aerial lines in regions of …

Construction of aerial lines for IDGCs

Fig. 19. Planned volumes of construction of aerial lines for interregional distribution grid companies by major energy constructing enterprises in 2011-2012, km

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

… plan to erect most aerial lines for IDGCs in 2011-2012.

At that the …'s work area covers most regions, while other companies are focused on two-three regions.

…

Construction of aerial lines and substations for "other" customers

Fig. 20. Volumes of construction of aerial lines for "other" customers by major energy constructing companies in 2010, km

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

"Other" customers mean municipal grid companies, plants and factories, ports, etc.

Fig. 21. Volumes of construction of aerial lines for "other" customers by major energy constructing companies in 2011-2012, km

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

Fig. 22. Volumes of construction of substations for "other" customers by major energy constructing companies in 2010, MVA

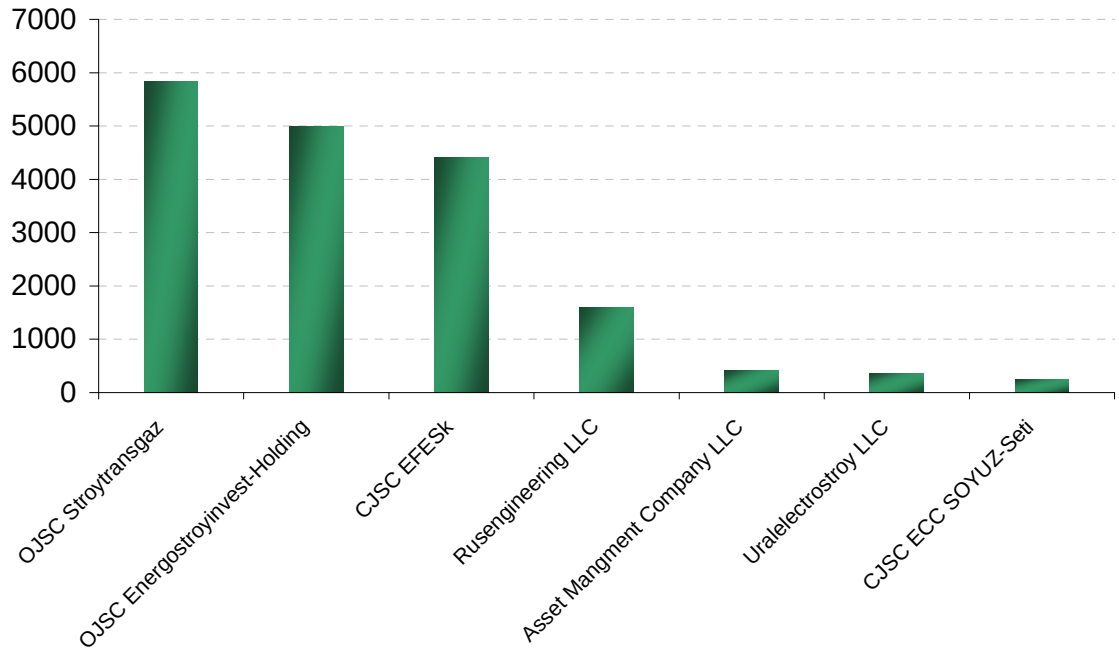
…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011.

…

Headcount

Fig. 23. Average headcount of major energy constructing companies in 2010, persons



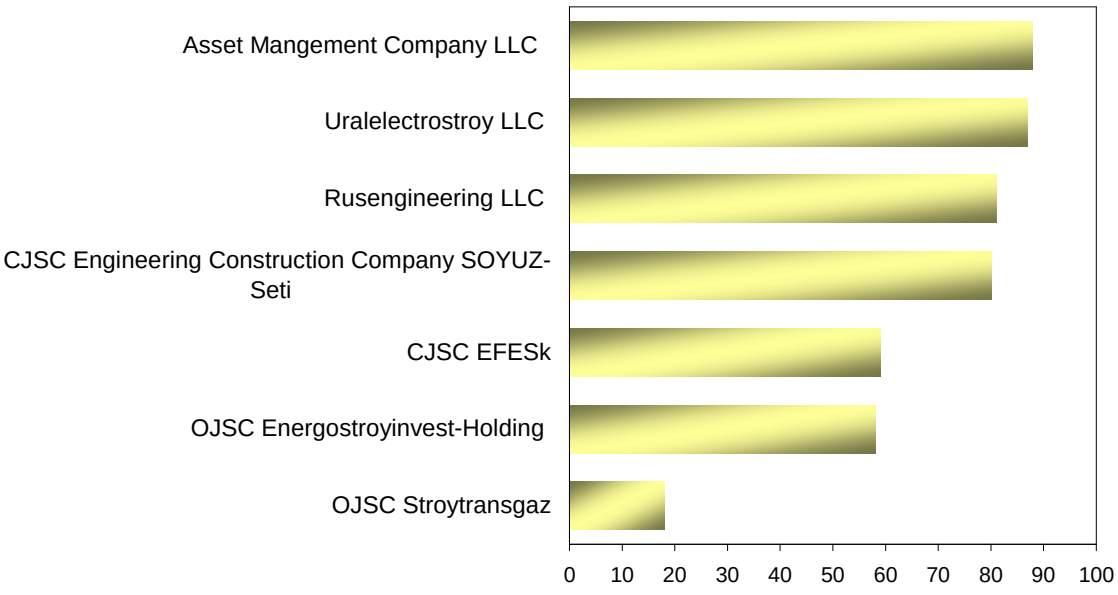
Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

Fig. 24. Average headcount of key operating personnel, engaged in construction of power engineering facilities, in 2010, persons

...

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

Fig. 25. Share of key operating personnel, engaged in construction of power engineering facilities, in total headcount of energy constructing companies in 2010, %



Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

Fig. 26. Average headcount of major energy constructing companies (forecast for 2012), persons

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

Fig. 27. Average headcount of key operating personnel, engaged in construction of power engineering facilities (forecast for 2012), persons

…

Source: companies' data, calculations of RBC.research (RBC Department of Consulting), 2011

The above diagrams show that the operating personnel headcount in such companies as …, … and … is well above that of other energy constructing companies, both according to 2010 data and according to forecasts for 2011-2012. On the contrary, such companies as …, … dispose of a rather modest headcount while performing a rather large volume of works. It may mean that such companies have to resort to subcontracting in order to perform the entire amount of works more often.

ANALYSIS OF CHARACTERISTIC ASPECTS OF ACTIVITIES OF EXISTING DESIGN INSTITUTES AND ASSESSMENT OF THEIR IMPACT ON THE MARKET

Analysis of the current situation in the market of design services

…

Analysis of performance indicators of design institutes in 2010 (analysis of work amount. headcount)

Analysis of work amount

Among the largest design institutes the following ones may be singled out by volume of proceeds: OJSC Urals Power Engineering Centre, OJSC South Centre of Power Engineering, OJSC North-West Power Engineering Center (SevZapNTC), OJSC Siberian Power Engineering Research and Development Centre, OJSC Dalenergosetproject .

In 2010 … became the leading design institute in terms of works performed. Having increased the amounts of works in 1.5. times compared to the previous year, … left behind the 2009 leader - …, which weakened its positions in 2010, having decreased the amounts of works in monetary terms by …%.

… managed to keep its 2009 position and remain the third in 2010, despite reduction of proceeds by … mln. rubles compared to the previous year.

Fig. 28. Shared distribution of design institutes broken down by volume of proceeds, 2009, %

Source: calculations of RBC.research (RBC Department of Consulting), 2011.

Table5. Rating of design institutes by volume of proceeds, 2009, 2010

№	Company Name	Amount of works in 2009, thsd. RUB	Amount of works in 2010, thsd. RUB	Growth Rate, %.
…	OJSC Urals Power Engineering Centre			
…	OJSC South Centre of Power Engineering			
…	OJSC SevZap NTC			

№	Company Name	Amount of works in 2009, thsd. RUB	Amount of works in 2010, thsd. RUB	Growth Rate, %.
…	OJSC Siberian Power Engineering Research and Development Centre			
…	OJSC Dalenergosetproject			
	CJSC Energoproject			
	OJSC Institute ENERGOSETPROJECT			
	MEP (MosEnergyProject) – a branch of OJSC FEC MOSENERGO			
	OJSC R&D Centre for Power Engineering			
	CJSC Yugenergoproekt			
	OJSC Volga Power Engineering Centre			
	CJSC Electrosetproject			
	SEP LLC			
	Long - distance Transmission Division LLC			
	Premier-Energo LLC			
	UralSoftProject LLC			
	Severelectroproject LLC			
	TOTAL			

Source: RBC.research (RBC Department of Consulting), 2011

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Headcount

Table6. Rating of design institutes by headcount, 2009, 2010

№	Company Name	2009, persons	2010, persons	Growth Rate, %.
		…		

Source: RBC.research (RBC Department of Consulting)

Table7. Rating of design institutes by operating personnel headcount, 2009, 2010

№	Company Name	2009, persons	2010, persons	Growth Rate, %.
		…		

Source: RBC.research (RBC Department of Consulting)

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