

Perspective balance of the electric power of Siberia in view of development energy cooperation of Russia and the countries of Asia

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The summary. Recently electricity consumption is steadily increasing in Siberia. Energy experts consider different projects of development of generating capacities in territory of Siberia for the long term. Opportunities of export from Siberia are limited as backwardness of grids structure and absence of sufficient capacities, also perspective growth of power consumption inside region. The question on expediency of the electric power export remains disputable. For a substantiation is it necessary to carry out additional researches and full-scale calculations.¹

Siberian federal district (SFD), being is superfluous on capacity, is scarce on the electric power. Since 2000 in SFD deliveries of the electric power from Kazakhstan and Ural FD were carried out. In 2009 generation of the electric power in OES Siberia has made 203,4 bn. kWh, and a power consumption - 210,9 bn. kWh. For OES significant non-uniformity of accommodation of generating capacities is characteristic at insufficient development of electric networks.

With abolition of the centralized system of distribution of resources and transition to market attitudes the scheme of forward planning of the country has been destroyed, and the role of balance as system document was reduced to a minimum. Power have been deprived quantitative reference points - perspective demand for production, requirements to its quality, restrictions on resources, etc. Specificity of thermal power station will be, that rather expensive decisions on construction of the majority of power objects should be accepted long before occurrence of real demand for their production while delay threatens with the big social and economic losses in the future.

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During last years representations about perspective balance of the electric power of Russia and Siberia varied rather essentially. The main reason of miscalculations in the forecast energy consumption in early program documents was absence of complete system of forecasting of a condition of economy.

The second, the reason weak study of a regional section was not less important. At a regional level there was no neither information, nor normative-legislative, a financial base for such decision of a problem, and the federal level has not created conditions necessary for it. As consequence in regions there were no regional social and economic programs and regional power programs which could be coordinated with the top level.

In 2003 «Power strategy of Russia for the period till 2020» has been authorized. It would seem, that possessing such information, power engineering specialist have received, at last, a reliable basis for construction of forecasts energy consumption. Under methodical management Energy Research Institute of the Russian Academy of Science annual sliding forecasting of development of electric power industry for the five years' period began to carry out «RAO EES», have appeared perspective balances of the electric power and centralized heat. Practice has shown, that the competence for construction of qualitative forecasts does not suffice. At press conference «the New power policy» on December, 20, 2005 Chairman of Board of «RAO EES» A.B. Chubays has declared, that «has found out completely gaping break between those parameters which the country assumed to see in development energy consumption so both all power, and those parameters which already on the fact are».

It is guilty in it, in opinion of analysts of «RAO EES», there was an economic growth in the country, naturally stimulated such scales of a current consumption which nobody could

predict: actual growth of gross national product for 2006-2006 has made 31 % instead of predicted at development of Strategy of 13-15 %.

Sharp growth energy consumption was imposed on exhaustion of reserves of capacities, deterioration and leaving of the electropower equipment. The output from this position which have received the name «Chubays's cross», was represented obvious: replacement a developing service life and input of new capacities. For investment activity at this time in the country the opportunity - both at private business was and the state had many money.

For a substantiation of necessity and investment appeal of the big scales of input of generating capacities of RAO EES has undertaken a number of steps. In particular, in 2005 the closed joint-stock company «Agency on forecasting balances in electric power industry» (Joint-Stock Company "AFBE") which duties included « maintenance of bodies of the government and power community key forecast for formation of strategy, long-term and intermediate term programs, investment projects in electric power industry» has been founded. With creation AFBE the amount of documents and programs of development in which basis forecasts of the future levels energy consumption laid, has sharply increased.

In table 1 parameters in absolute expression and values of a mid-annual gain of a power consumption in SFD, taken of forecast documents developed in 2000th years are resulted.

1- *Power strategy of Russia for the period till 2020 (2003 z)*

2- *The general Scheme of Allocation of Objects of Electric Power till 2020 (2007)*

3- *Script conditions of development of electric power industry of the Russian Federation for 2009-2020, AFBE (2008)*

5- *Materials to the project « Strategy of Siberia till 2020 » Institute of economy and IE the Siberian Branch of the Russian Academy of Science (2008)*

6- *Power strategy of Russia for the period till 2030 (November, 2009)*

7- *Script conditions of development of electric power industry for the period till 2030, AFBE (2009)*

8- *Strategy of social and economic development of Siberia till 2020, the Plenipotentiary representation of the President of the Russian Federation in SFD (2010)*

9- *The project of Strategy of social and economic development of Siberia, IEIE SBRAS (2009-2010)*

TABLE 1. PERSPECTIVE VOLUMES OF CONSUMPTION AND MID-ANNUAL INCREASE THE POWER CONSUMPTION, BN. KWH AND %

	2010 г.		2015 г.		2020 г.		2030	
	min	max	min	max	min	max	min	max
1-Energy Strategy-2020	226 2,2%	231 2,8%	248 1,9%	253 1,8%	272 1,9%	278 1,9%		
2- General Scheme	250 4,8%		289 2,9%		342 3,4%	438		
3-AFBE	240 3,8%	259 5,8%	278 3,0%	325 4,6%	331 3,6%	426 5,6%		
4-IEIE	218 1,3%	219 1,4%	249 2,7%	265 3,9%	304 4,1%	344 5,4%		
5-ES-2030			4,0%	4,3%	3,8%	4,3%	3,0%	3,4%
6-AFBE	200 -0,8%	200 0,8%	235 3,2%	239 3,6%	257 1,8%	275 2,8%	305 3,5%	349 4,9%
7-Strategy of Siberia		225,3 2,2%		259,7 2,9%		288,5 2,1%		
10-IEIE	202 -0,6%	207 0,0%	230 2,6%	237 2,7%	273 3,5%	312 5,7%	362 5,8%	411 6,4%

From table it is visible, that in the documents prepared till 2006, the pessimistic point of view on an opportunity of growth of a power consumption in SFD prevailed. Mid-annual rates of growth of a power consumption were predicted at a level of 1,5-2 %. In the documents prepared in 2006-2008, optimism has sharply raised, and values increase have grown up to 4-6 %.

The divergence perspective the data prepared at various times, speaks that at an estimation of volumes of a power consumption for 10-20 years forward as the basic the approach based on application simplified econometric of models on the basis of interpretation of elasticity of a power consumption under gross national product in the retrospective period was

used. During recession of 1990th average elasticity of dynamics of consumption on economic growth made about 0,7, that is consumption of energy and gross national product changed synchronously enough. After 1998 - during fast economic growth - communication between these sizes broke up. Average elasticity energy consumption on a gain of gross national product for the period of 1999-2004 has made about 0,2-0,3 - at growth of gross national product on 1 % consumption of energy increased for 0,2-0,3 %. Such position reflected the occurred structural changes in the Russian economy - reduction of some power-consuming industries, increase in a share of services, transport and connection in economy, and also the general increase of efficiency of use of energy and reduction of losses. In an initial stage of growth (till summer 2006) many observers were sure in preservation concerning low rates of growth of consumption of energy, even in conditions of significant growth of gross national product.

Growth of a power consumption in 2007-2008 appeared substantially unexpected event for analysts. It has led to occurrence the Project of the General Scheme of Allocation of Objects of Electric Power Industry for the Period till 2020 which started with an assumption about high elasticity of a current consumption under gross national product the nearest 10-20 years.

In a heat of development of Power strategy - 2030, autumn of 2008, began system crisis. Values of indicators in a final variant of Strategy which has been accepted by the Government of the Russian Federation of 13.11.2009, are essentially lower than estimated figures of the variants discussed in the beginning of 2009 though it is visible, that under the maximal script a level of indicators still try to keep. But in Script conditions of development of the electric power industry, prepared in 2009, and the top borders about 2-3 % till 2020 are lowered.

As shows experience, it is necessary to be very cautious at distribution of short-term tendencies for the intermediate term periods - the forecast of demand for energy requires additional studying and an estimation.

First, there is a question what perspective dynamics of gross national product to take for a basis of calculations? In fact actually work on formation perspective the variant of development of a national economy coordinated with plans for development of key industries, is not ended yet.

Second, changes in branch structure of the Russian economy proceed. Desirable for successful development of economy the increase in speed and a degree diversify manufactures and export will certainly affect dependence of a power consumption on dynamics of gross national product.

We count, that at forecasting within the framework of formation of strategic program documents it is necessary to base not only on perspective dynamics of gross national product. Scales, rates and economic efficiency of production and transportation of the electric power, gas, coal, oil and mineral oil essentially depend on dynamics of change of solvent demand for all kinds of energy carriers. And last, in turn, is connected by the most direct image to rates of change of scales and structural shifts in economy. Therefore forecasting of needs of region in fuel and energy should be carried out on the basis of generalized industrial (output in the comparable prices) and power characteristics (energy intensity) on sectors of economy and kinds of economic activities.

In our opinion for research of interaction in system "Economy - energy" use of a complex of the models including as model of interbranch balance of the goods and services, and the industrial - financial models describing coordinated development of branches of thermal power station which allow to analyze consequences of accepted decisions regarding industrial, investment, price, a tax policy in these branches are preferable.

The technique of construction accounting and perspective the regional fuel and energy forecasts, developed in IEIE SBRAS, bases on the methodology of carrying out advanced in institute perspective calculations on the basis of the economic-mathematical toolkit united in system SONAR-FEC. At the present stage this

system has rather complex and ramified structure. The block of national economy including designs, covering all Russian economy (model OMMM-FEC), the block of regional models which cover economy of separate zones and regions, and also the block of models of "region TEB" into which power models mezo-and a regional level enter is allocated: Power model of Russia, Model of perspective development of thermal power station of regions, Accounting and perspective fuel and energy balances of regions.

Carried out IEIE during development of the new version «Strategy of social and economic development of Siberia till 2020» calculations with use of the toolkit described above have shown, that at the general increase power efficient economy and scale development energy saving (electrocapacity GDP SFD will decrease on 13 %) mid-annual growth of a power consumption in territory of district will make 2,4 %. The total volume of a power consumption in 2020 can reach 273 bn. kWh, and in 2030 - 362 bn. kWh (tab. 3).

It speaks input of the whole series of power-intensive industrial targets, occurrence of new industrial zones of development of primary resources in the Bottom Angarski Krai and the Baikal region. It is expected, that the essential gain of a power consumption will be observed and in a zone of realization of new infrastructural projects, including constructions of the North-Siberian trunk-railway and new branches from the Transsiberian and Baikal-Amur highways to mastered deposits.

The burst crisis at 2008 has changed the image of the future made in the General circuit of accommodation of objects of electric power industry. Except for satisfaction of internal needs SFD according to project General circuit input of new power stations for deliveries of capacity and the electric power for limits of district was assumed: export to the Mongolian republic and China in total volume to 2015-2020 36 kWh; transfer from OES Siberia in OES Ural and OES the Center in total amount in 2015,5-9,0 kWh, in 2020 25-41 bn kWh. Maintenance of the given volumes of export is planned due to input of power units on new

Haranorskaya (3x800 MW), Turovskaya (2x600 MW) and Olon-Shibirskaya (4x900 MW). However, till now in spite of the fact that plans on construction of these objects are declared on behalf of the RAO EES, concrete investors are unknown. Thus, is not present proved parallel the plan for development of raw coal base for the given stations.

In connection with crisis these arrogant plans have undergone to revision aside putting off for later term. In conditions of instability of a world conjuncture in the world markets of fuel and energy and uncertainty with perspective need for the electric power of the developing states, the priority will be given satisfaction of own requirements SFD.

In our opinion, the basic supplier of the electric power in the countries ATR it is necessary to consider power stations of the Far East, as from the point of view of geographical affinity, and existing long-term arrangements on cooperation. For example, according to the program of cooperation between frontier regions in FAP «Economic and social development of the Far East and Transbaikalia» and «the Program of revival of areas of Northeast of China» one of key projects writes down a construction of new power stations and an electronetwork infrastructure.

Opportunities of deliveries of the electric power from Siberia to China, in our opinion, are small. A principal cause of it is that there are no worked enough long bilaterial contracts, there are no proved projects of maintenance of raw coal base for planned stations.

The balance of Siberia should be direct in the greater degree for maintenance of internal consumption, and also for possible deliveries to Ural and the European part of Russia (tab. 2.)

TABLE 2. BALANCE OF ELECTRIC POWER SFD, BN KWH

	2008	2010	2015	2020	2030
Production	206,1	193,2	237,5	304,2	394,7
Consumption	214,0	202,0	230,0	273,0	362,0
Balance	-7,9	- 8,8	7,5	31,0	32,7

But till now in one program document there was no precise picture of internal consumption, and to speak about export rather difficultly.

Our results perspective calculations show, that in accepted script conditions of development is unreal to speak about export of the electric power from territory SFD to China at a level 36 bn. kWh in 2015 as it was panned in General scheme. Us, the total amount of deliveries of the electric power for limits of region, is estimated at a level 7,5 bn. kWh by 2015 and 30 bn. kWh after 2020.

The problem of integration of electric systems should not be reduced completely to export priorities. As a variant alternative to possible export highways it is possible to put forward idea cross-feeding power supply systems in scales of the Euroasian continent for the decision of a task of redistribution of the electric power from superfluous regions of Siberia in scarce. Functioning of a similar uniform power system probably on the basis of multilateral interstate agreements and, undoubtedly, will demand the weighed policy of each state which are included in this system.

For maintenance of planned growth of a power consumption in SFD and deliveries for limits of district adequate growth of generation is required due to scale input of new generating capacities (tab. 3).

By the end of the considered period the general established capacity of generation can make about 85,7 GW, having increased in 1,85 times. The share of hydrostations in generation of the electric power in SFD will be reduced from 49,1 % in 2008 up to 30,3 % in 2030. In the long term needs in thermal energy will grow more slowly, than needs for the electric power, therefore inputs of capacities on thermal power station will lag behind input SDPP. In result, the share of thermal power station in total development of electric power SFD will decrease from 31,1 % in 2008 to 25,2 % in 2030, share SDPP, on the contrary, will increase according to 19,1 % up to 40,1 %, due to construction and expansion of such large power stations as Berezovskaya-1 and-2, Kanskaya, Haranorskay, Tom-Usinskaya,

Bakcharskaya,
Tataurovskay, etc.

Gusino-Ozerskaya,

TABLE 3. THE FORECAST OF CAPACITY AND GENERATION OF THE ELECTRIC POWER IN SFD

	2008 отчёт	2010	2015	2020	2030
Capacity, mln kWh	46,3	43,2	54,6	66,9	85,7
Generation, bn. kWh	206,1	193,2	237,5	304,2	394,7
% Atomic power stations	0,6	0,7	0,5	3,1	4,4
Hydroelectric power stations	49,1	40,3	44,3	36,6	30,3
State district power plant (SDPP)	19,1	22,7	23,3	32,0	40,1
Combined heat and power plant	31,1	36,2	31,7	28,3	25,2
Other	0,1	0,1	0,1	0,1	0,05

In spite of the fact that the economic situation after crisis was stabilized, the majority of the power companies have occupied a waiting attitude and they do not sound final plans on construction energy capacity, and also large investment projects with a significant power consumption till now are postponed. A number of the investment projects having the important inter-regional value, are in a zone of enhanced attention of authorities. Upon investors puts administrative pressure, both regional authorities, and the federal, investment programs demanding renewal being a pledge of regional development. From its part the state should render stimulating influence on private investments at outstripping development of a power and transport infrastructure at joint financing the state.

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