Energy security of the world and Russia: preconditions, capabilities, problems

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The paper addresses the problems of global energy security in various regions of the world. The present and future role of Russia in ensuring energy security is shown. Possible problems in the accomplishment of goals set in the Energy Strategy of Russia till 2030 are assessed in terms of realization of strategic threats to energy security of Russia. The most important points of ensuring energy security in the largest countries of Asia-Pacific region and the key positive aspects of Russia's integration into the energy space of the region are shown[*].

Key words: **Energy security, strategic threats, APR countries, energy cooperation**

1. INTRODUCTION

Global energy security (GES) represents a synthesis of energy security interests of different countries and regions of the world. According to [1] global energy security can be defined as a state of the world community (countries and their economies) being protected from the threats of tangible shortage when meeting their energy demand by economically accessible energy resources of acceptable quality. Large-scale realization of such threats is related to the risks of losing economic or political stability, deteriorating socioeconomic situation in the countries, slowing down or stopping economic growth and social progress in different regions of the world.

The paper considers energy situation in the world in terms of the global energy security, the main goals of Energy Strategy of Russia till 2030, the strategic threats to the energy security of Russia and to the global energy security, and the specific features of energy security problem in the APR countries.

2. GLOBAL ENERGY SECURITY AND ENERGY SITUATION IN THE WORLD

Energy security is achieved, on the one hand, by a sufficient supply of energy resources and, on the other hand, by a moderate demand satisfied by an efficient system of energy consumption.

The major reason for exacerbation of the GES situation in the past decades has been intensification of two global processes. First, this is a considerable increase in demand of the world economy for primary energy resources, which is particularly fast in developing countries (Table 1). Developing countries as well as those with transition economy (CIS, including Russia, and other European countries – former members of CMEA) have a high energy-GDP ratio. Second, this is exhaustion of relatively cheap natural energy resources in most world regions and the need to develop their more expensive reserves, which necessitates more sizable investment in the energy sector.

As seen from Table 1, in 2000-2009 the total consumption of primary energy resources in the world rose by 21 percent with an increase in primary electricity production only of 14 percent (nuclear power – from 2580 to 2700 TWh, hydro power – from 2650 to 3270 TWh). The antinuclear sentiment is still strong in the world, which is related to the security of nuclear energy, the problems of radioactive waste storage and burial, etc. Therefore, the main "burden" in the increasing consumption of primary energy in the past years has fallen again on traditionally utilized gas, oil and coal.

Currently:

- a steady long-term increase in the global demand for primary energy particularly in developing countries is projected. According to the World Energy Agency [3] by 2030 the world primary energy consumption may reach 25 bn tce, including in Asia-Pacific Region (APR) - 9 bn tce, in Africa, Latin America and in the Middle East, in to-

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tal, - 5 bn tce, while in North America and Europe, including CIS, – 10-11 bn tce;

TABLE 1.WORLD CONSUMPTION OF PRIMARY ENERGY RESOURCES, m tce

Region, country	2000	2005	2009	Increase in 2009 of 2000	
				Abs.value	Relative value
North America, including	**3928.6**	**4030.6**	**3810.1**	**-118.5**	**-3%**
USA	*3302.6*	*3349.3*	*3120.3*	*-182.3*	***-6%***
Canada	*429.6*	*462.0*	*456.5*	*26.9*	***6%***
Mexico	*196.5*	*219.4*	*233.4*	*36.9*	***19%***
Central and South America, including	**653.4**	**724.6**	**804.9**	**151.6**	**23%**
Brazil	*261.5*	*283.3*	*322.8*	*61.2*	***23%***
Venezuela	*88.5*	*97.7*	*105.2*	*16.7*	***19%***
Argentina	*84.2*	*95.0*	*104.8*	*20.6*	***24%***
Europe and Eurasia, including	**4000.0**	**4206.8**	**3961.1**	**-38.9**	**-1%**
Russia	*897.8*	*949.0*	*928.5*	*30.7*	***3%***
Germany	*471.2*	*462.7*	*414.4*	*-56.8*	***-12%***
France	*362.5*	*371.9*	*345.9*	*-16.6*	***-5%***
Great Britain	*318.7*	*322.0*	*284.4*	*-34.3*	***-11%***
Italy	*250.1*	*261.7*	*233.7*	*-16.4*	***-7%***
Spain	*184.0*	*209.1*	*189.6*	*5.6*	***3%***
Ukraine	*192.6*	*194.6*	*160.9*	*-31.7*	***-16%***
Poland	*126.4*	*129.7*	*132.0*	*5.6*	***4%***
Netherlands	*124.7*	*137.0*	*133.4*	*8.7*	***7%***
Kazakhstan	*58.5*	*81.5*	*92.1*	*33.6*	***57%***
Belorussia	*30.3*	*33.9*	*34.2*	*3.9*	***13%***
Sweden	*69.5*	*72.6*	*61.8*	*-7.7*	***-11%***
Turkey	*109.5*	*128.0*	*133.0*	*23.5*	***21%***
Uzbekistan	*71.4*	*66.1*	*73.6*	*2.3*	***3%***
Middle East, including	**582.6**	**781.9**	**942.4**	**359.8**	**62%**
Iran	*173.2*	*251.5*	*292.9*	*119.7*	***69%***
Saudi Arabia	*169.0*	*222.4*	*273.8*	*104.8*	***62%***
United Arab Emirates	*58.9*	*81.4*	*107.3*	*48.3*	***82%***
Africa, including	**399.5**	**468.0**	**515.9**	**116.4**	**29%**
South African Republic	*153.4*	*170.6*	*181.3*	*27.9*	***18%***
Egypt	*71.2*	*89.2*	*109.1*	*37.9*	***53%***
Algeria	*38.5*	*46.8*	*56.8*	*18.3*	***48%***
APR, including	**3677.1**	**4896.6**	**5930.5**	**2253.4**	**61%**
China	*1383.2*	*2248.2*	*3113.1*	*1729.9*	***125%***
Japan	*729.6*	*743.2*	*663.4*	*-66.2*	***-9%***
India	*422.0*	*517.9*	*670.5*	*248.5*	***59%***
South Korea	*270.0*	*316.7*	*339.6*	*69.6*	***26%***
Australia	*152.3*	*166.9*	*170.5*	*18.2*	***12%***
Indonesia	*138.1*	*171.5*	*183.3*	*45.2*	***33%***
Taiwan	*133.8*	*155.3*	*151.2*	*17.3*	***13%***
Thailand	*93.8*	*127.0*	*136.0*	*42.2*	***45%***
Malaysia	*64.9*	*79.9*	*79.7*	*14.7*	***23%***
Pakistan	*63.3*	*84.2*	*94.1*	*30.7*	***49%***
Singapore	*50.1*	*66.8*	*86.9*	*36.9*	***74%***
World, total	**13241**	**15108**	**15965**	**2724**	**21%**

Source: [2]

- there are no trends toward energy conservation in most of developing countries and countries with transition economy, and toward an energy saving style of life in the rest of the countries;
- slow pace of renewable energy development;
- there is a strong resistance to the development of nuclear energy.

Besides, the areas of traditional hydrocarbon production are situated far from the areas of consumption. The first group of areas is mostly characterized either by political instability or by complicated conditions for production increase. Many countries are characterized by poor diversification of energy supply (by energy type) which puts a strain on consumers of hydrocarbons and their shortage in the future. Motor oil fuel today dominates energy supplied to the transport sector in the majority of countries in the world. Electric power industry in the countries of Western, Eastern and Central Europe, Middle and Near East, North Africa, some countries in APR and European Russia is mainly oriented to natural gas. The level of technology in the energy sector of developing countries and countries with transition economy is low which fosters general wasteful energy consumption.

Table 2 shows that the situation concerning the satisfaction of energy demand varies by region. The demand for primary energy resources in Central and South America, Middle East and African continent can be met only by their local production. Certainly, these regions and the countries within these regions have different situations. For example, in many African and in some South American countries a relatively low standard of living is accompanied sometimes by unacceptably low level of energy consumption. Therefore, with increase in the standard of living energy intensity of the economy will rise and the available local primary energy resources may become insufficient for these regions.

TABLE 2. PRODUCTION AND CONSUMPTION OF PRIMARY ENERGY RESOURCES IN THE MAJOR WORLD REGIONS IN 2009, Mtoe [2]

World region	Oil	Gas	Coal	Energy of NPP and HPP	Total	Consumption	Surplus, shortage (-)	Relative shortage, %
North America	629	739	578	371	2317	2664	-347	13
Central and South America	339	136	53	163	691	563	128	
Europe and Central Asia, including Russia	855	876	420	447	2598	2770	-172	6
without Russia	*361*	*401*	*279*	*370*	*1411*	*2135*	*-724*	*34*
Middle East	1156	366	1	3	1526	660	866	
Africa	459	184	143	25	811	361	450	
APR	383	395	2213	342	3333	4147	-814	20

Relatively insufficient capabilities to meet the demand for primary energy resources by the local sources is typical of the world regions with high share of industrially developed or intensively developing countries. These are North America, Asia-Pacific Region and Europe.

For several years an increasing energy demand against the background of a much slower rise in supply has affected the prices of all types of energy resources through their increase. This process represents a serious threat to the economy of the world and some countries. The strain on energy supply before some revolutionary changes in energy produc-

tion are made, i.e. for a rather long period of time, will not decrease but increase. This will have a negative impact on the growth rates of the world GDP. The countries with low revenues that import energy resources will face major difficulties. This is fraught with serious socio-economic and probably political perturbations. These issues have been raised for a long time [4].

Table 2 shows that under conditional integration of Europe with the countries of Central Asia the shortage of their own primary energy resources is relatively low (6% of their consumption volumes in 2009). In order to understand what role of Russia in this situation is we will deduct the volumes of primary energy produced and consumed in Russia from the volumes of European production and consumption of energy resources. Without participation of Russia Europe will face a primary energy shortage of 34 percent, whereas the share of Russia in satisfaction of energy demand of this macro region of the world (including Russia's demand) is 28 percent. At the same time the share of Russia in consumption of primary energy for this region is 23 percent. Since the demand for primary energy in this region is expected to increase European countries will be interested in Russia as a major supplier of these resources till 2030 and further.

Analysis of Tables 1 and 2 makes it possible to compare the soaring consumption of primary energy in APR that depends considerably on external supplies of these resources. The most active players in this market are China, Japan and South Korea that are interested to a great extent in energy resources of Russia's East. Thus, the Russian resources should participate in ensuring energy security, both in European region and in APR.

Will Russia be able to cope with the role of an energy security guarantor in these regions, and, if yes, what positive factors can be conducive to this? We will try to answer these questions below.

3. MAIN TARGETS OF RUSSIA'S ENERGY STRATEGY TILL 2030

The conception of long-term national development that underlies the Energy Strategy of Russia till 2030 (ES-2030) [5] envisages large-scale structural transformations in the economy in terms of both GDP and the sector of industrial production. Market demand is supposed to foster the outpacing development of less-energy-intensive sectors of industrial production that specialize in the high-technology and science-intensive products, while energy intensive productions will develop much more slowly which should result in the structural transformation of Russia's economy towards less-energy-intensive sectors and industries.

According to the ES-2030 **at the first stage** of its implementation the prospecting work will be activated in the traditional areas of energy resources production. Besides, all necessary conditions (normative - legal, tax, institutional, etc.) will be created to develop mineral resource base of fuel and energy complex (FEC) in remote and hard-to-access areas of the country, including East Siberia and the Far East, the shelf of the northern seas and the Yamal peninsula. A centralized vertically-integrated system for control of mineral resources will be created to achieve their most efficient and comprehensive development. By the end of the first stage the relationship between the annual additions to reserves and the volume of energy resources production will near 1.

At the second stage active development of oil and natural gas will start in East Siberia, the Far East and shelf areas, including the areas in the Russian sector of Arctic, as well as on the Yamal peninsula, in the Gulfs of Ob and Taz, European North and the Caspian Region. The prospecting work will be performed by the advanced technologies using 3D seismic methods. The volumes of prospecting will rise, their efficiency will be enhanced. This will provide steady reproduction of mineral resources of the main industries within FEC.

At the third stage development of the new areas will be continued on the basis of advanced exploration methods and technologies,

through the public-private partnership and the attraction of investments, including foreign ones. Maintaining the production volumes of energy resources will call for considerable capital investment in the advanced technologies for their exploration and production. The energy resources in the main areas of their production will decrease.

The targets outlined in the ES-2030 on the basis of appropriate GDP growth rates, decrease in energy – GDP ratio and the development rates of energy industries, are presented in Table 3.

TABLE 3. BALANCE OF PRIMARY ENERGY RESOURCES ACCORDING TO ES-2030, m tce

	2015	2020	2030
Internal consumption, including	**1010–1110**	**1160–1250**	**1375–1565**
Gas	*528-573*	*592-619*	*656-696*
Liquid (oil and condensate)	*195-211*	*240-245*	*309-343*
Solid fuel (coal, etc.)	*168-197*	*198-238*	*248-302*
Non-fuel	*117-127*	*130-147*	*163-224*
Export, including	**913-943**	**978-1013**	**974-985**
Gas	*310-340*	*380-390*	*400-425*
TOTAL CONSUMPTION	**1923-2052**	**2140-2266**	**2363-2542**
RESOURCES	**1923-2052**	**2140-2266**	**2363-2542**
Import	**96-100**	**92-93**	**86-87**
Production – total, including	**1827-1952**	**2047-2173**	**2276-2456**
Gas	784-853	919-958	1015-1078
Liquid (oil and condensate)	691-705	718-748	760-761
Solid fuel(coal, etc.)	212-260	246-311	282-381
Non-fuel	134-140	156-164	219-236

With the main ES-2030 targets achieved Russia can enhance its participation in ensuring global energy security by 2030 through the increase in export of primary energy resources by 11-12 percent against 2009.

At the same time for a fairly long time Russia has been facing serious problems hindering the accomplishment of the plans formulated in the ES-2030. These are strategic threats to energy security.

4. STRATEGIC THREATS TO ENERGY SECURITY OF RUSSIA

The key strategic threats to energy security of Russia include [6, 7]: wasteful energy consumption; low rates of elimination of gas and coal price distortions; a lag between additions to the explored reserves of hydrocarbons and volumes of their production; a decrease in gas production volumes due to economic risk of developing gas resources of the Yamal peninsula and shelf of the northern seas; an extremely high share of natural gas in the energy balance of Russia's European regions; an insufficient level of investment in the FEC industries; highly worn equipment and low rates of its upgrading in the FEC industries.

High energy-GDP ratio in Russia is determined first of all by the use of energy wasting technologies and equipment, high energy transportation and storage losses, in part by the irrational structure of the economy. In the conditions of still continuing economic crisis there can be a certain delay in the enhancement of energy efficiency of the economy, which is related to the implementation of energy efficient technologies in energy production and consumption, restructuring of the economy, and to a sharp increase in the share of science-intensive sector of the economy.

Low rates of elimination of gas and coal price distortion have led to the irrational, in terms of energy security, structure of demand for primary energy resources. This manifests itself in the excessive orientation towards natu-

ral gas. An acceptable proportion of coal price to gas price, bearing in mind the practice in other countries, should be no less than 1:1.4 - 1:1.5 (per 1 tce) at a current proportion of 1:1.

Slow elimination of price distortion retards the required energy balance diversification, aggravates the threat of natural gas dominance in the energy balance of European Russia and weakens national energy security under conditions of delay in development of new gas production areas, which will be discussed further. At the same time a too fast change in this relationship now can result in a deep crisis in the domestic production.

A lag between additions to explored reserves of hydrocarbons and the volumes of their production. An extremely unfavorable situation is emerging in the oil industry: in which resources are depleted at a particularly rapid pace.

Russia's oil resources are estimated at 44 bn t. At the same time at the beginning of 2010 the recoverable oil reserves in Russia, according to different estimates [2], made up 10- 20 bn t. The quality of oil reserves is deteriorating. Comparatively small additions to reserves have been made over the past years through additional exploration of previously discovered fields and conversion of inferred reserves to explored ones. Currently it is necessary to develop the areas with more expensive oil. Specific investment (per ton of oil produced) in Russia is almost by 2 times lower than in the other countries (40-50 against 25-29 USD/t). The decrease in prospecting work that started in the early 1980s still continues.

Despite the fact that the natural gas reserves of Russia are rather large (the hypothetical reserves – 236 tn m^3, proved – 48 tn m^3) most of them are situated on the shelf of the northern seas and in hard-to-access areas of Siberia and the Far East. Their development requires tremendous additional expenditure of material and labor resources. Additions to the explored reserves of natural gas over the past 10 years have exceeded its production by the value of slightly above 10% at a desirable surplus of no less than by 1.2 times. The main additions to gas reserves were also made at previously discovered fields (the volumes of geological prospecting in new areas are insufficient due to low financing). The compensation of decreasing annual gas production at the main currently operating, and, to a great extent, depleted fields is insufficient. It is necessary to develop new areas with much more expensive gas.

Decrease in gas production due to economic risk of developing gas resources on the Yamal peninsula and shelf of the northern seas. One of the major strategic threats to Russia's energy security is the threat of *delay in development of gas reserves on Yamal and the shelf of the northern seas.* This delay can result in *lower levels of gas production in the country than those required* in the nearest future to meet the domestic and export demand. Working out the strategy for development of gas reserves on the Yamal peninsula the JSC "Gazprom" determined a rational schedule of its development and substantiated the maximal value of annual gas production on the peninsula in the amount of 250 m^3/year. Delay in development of gas reserves on Yamal after 2012 can noticeably affect the volumes of gas production in the country and, thus, the accomplishment of goals posed by the ES-2030. In the event of delay in development of other new areas with the largest fields the situation with future gas supplies can become even worse. An important objective reason for the delayed development of Yamal and the shelf of the northern seas can become *a big economic risk of developing these areas*. The analysis carried out in [6, et al] shows that the cost production of gas in the fields of Yamal may make up about 240 USD/thousand m^3, gas production cost of the Cara sea self – no less than 300 USD/thousand m^3 which may turn out to be too close to the level of gas prices expected in Central Europe. The indicated difference determines the degree of economic risk of developing new gas production areas and, bearing in mind the difficulties in improving the investment climate in Russia, the problem of starting the development

of new gas production areas is growing increasingly more urgent.

A large share of natural gas in the fuel balance of Russia's European regions. The dominating, and in some cases almost the monopoly role of natural gas in the energy balance of European Russia (Central, Volga, North-Caucasus, Southern Federal Districts - above 90%, Northwestern Federal District – 75%) makes the economy of these regions too dependent on reliable supplies of gas produced and transported mainly from one gas production area. Gas is supplied at the distances of 2500-3000 km along the system of main gas pipeline exposed to great danger of anthropogenic and natural impacts. This is fraught with serious problems in ensuring energy security of European territory of the country in the conditions of decreasing gas production in the long run. Besides this is related to large-scale extraordinary situations in gas industry. The reasons for the situations may vary and include in particular those pertaining to severe wear of basic production assets (BPA). The increase in the already high share of natural gas in the fuel balance in European regions of Russia that has occurred so far makes its any decrease in the near future problematic, which leads to the persistence of the considered strategic threat to energy security during a rather long period of time.

An insufficient level of investment and a slow pace of equipment upgrading in the FEC industries. In the past 15-20 years the investment allocated to FEC has been insufficient and used mainly for simple reproduction. As a result, the share of equipment with expired service life has risen and its wear has increased. Production assets removed from service are not replaced, there is a decrease in the technological level and economic efficiency of the energy sector. Severe wear of equipment results in high production cost and energy intensity of energy resources production and forces investments, first of all, in modernization of production facilities and in new capacities intended to replace worn equipment. By 2010 about 70 percent of *main oil pipelines* had operated for more than 20 years, of which half had been in operation for more than 30 years. In the *gas transportation* system about 30 percent of linear pipeline portion and 10 percent of gas pumping units at compressor stations have been in operation for more than 30 years. Already the third program for reconstruction of gas transportation network has been financed only by 25 percent. The problem of BPA wear in *electric power industry* is getting extremely urgent. The total capacity of the obsolete equipment at power plants of the country has neared 40 percent of the total installed capacity in the country. In the recent years about 1-2 m kW of generation capacity has been placed in operation. Despite the high degree of BPA wear in the *FEC industries* the replacement factors over the last decade have been below 2 percent (except for oil production – about 4 percent).

The considered strategic threats in terms of their negative consequences are characteristic of the entire country and of all RF entities. Realization of the threats to a greater or lesser degree in the considered time horizon can considerably change the ideas about the level of development required for various industries within the fuel and energy complex, that were presented in the documents that underlie the Energy Strategy of Russia till 2030. The studies carried out in [7] show that the potential realization of strategic threats to energy security may result in the indicators of primary energy production in Russia, that are presented in Table 4.

Having compared the targets set in the ES-2030 (Table 3) and prospective production volumes of primary energy resources in Russia at potential realization of strategic threats to energy security (Table 4) we can obtain the volumes of possible underproduction of these resources by reference year (Table 5). The data of Table 5 show that the realization of strategic threats to energy security may cause serious problems with the accomplishment of the targets for production of primary energy resources, that are outlined in the ES-2030. Thus, the attainment of an acceptable level of

energy security of Russia in the medium and long term future requires considerable additional efforts of the State, energy companies and consumers of energy resources.

TABLE 4. CAPABILITIES OF RUSSIA'S FEC TO PRODUCE PRIMARY ENERGY RESOURCES, m tce

Indicator	Reference years			
	2010	2015	2020	2030
Oil and condensate	670-685	600-630	550-575	520-550
Gas	690-725	680-750	600-700	640-830
Coal	170-180	180-200	200-230	250-280
Electricity produced by Nuclear and Hydro power plants	110-120	120-130	130-170	180-220
Renewable and other energy resources	30-40	30-40	40-60	50-70
Total:	1670-1750	1610-1750	1520-1735	1640-1950

TABLE 5.COMPARISON OF ES-2030 TARGETS AND RUSSIA'S CAPABILITIES TO PRODUCE PRIMARY ENERGY UNDER REALIZATION OF STRATEGIC THREATS TO ENERGY SECURITY, m tce

Indicator	Reference years		
	2015	2020	2030
Production according to the ES-2030	1827-1952	2047-2173	2276-2456
Capabilities under realization of strategic threats to energy security	1610-1750	1520-1735	1640-1950
Potential underproduction*	**200-220**	**440-530**	**510-640**
Relative shortage, %	**10-12**	**20-26**	**21-28**

* Rounded

Energy security of the country can be ensured and obligations to the world community can be fulfilled provided that strategic decisions at the Governmental level are made. In order to overcome the shortage of investment in FEC (including prospecting work) and intensify the upgrading of worn and obsolete equipment in the energy industries and the expansion of their capacities, of crucial importance will be the measures to create favorable investment climate and enhance economic efficiency of energy enterprises. It is also necessary to restructure the energy balance of the country towards increase in the share of coal, nuclear energy and, where possible, renewable energy sources, and to decrease the dominating role of natural gas. Of great importance for ensuring energy security will be the measures to enhance energy efficiency of the economy, which can be achieved through the upgrading of the basic production assets in the energy industries themselves.

5. ENERGY SECURITY OF APR COUNTRIES

As to the potentialities of energy cooperation in APR and Russia's participation in ensuring energy security in the region, special attention should be paid to the capabilities of producing the main types of energy in Russia's East.

This concerns two eastern regions of Russia – East Siberia and the Far East with the population of 17 m people and the territory of 10.3 m km^2 (60 percent of the country's territory). These regions possess the largest reserves of natural energy resources. The initial potential oil reserves in these regions, including the shelf of the far eastern and northern seas are estimated approximately at 17.8 bn t, natural gas – about 56 tn m^3. However, these reserves are mainly hypothetical, and the extent to which they are explored is little. As to the reserves of commercial categories, Russia's Eastern regions have about 400 m t of oil and about 3 tn m^3 of natural gas of categories $A+B+C_1$. On the basis of these reserves according to the ES-2030 oil production projected by 2015 in Russia's East is estimated at 45-60 m t and in the more distant future it

can reach 70-80 m t/year. These values include about 40 m t of resources to be exported. Gas production in Russia's East by 2015 is estimated at 45-55 bn m^3 including about 30-35 bn m^3 in the Sakhalin shelf. Export capabilities of Russia's Eastern regions in the more distant future are estimated at 50 bn m^3/year [5].

Russia's Eastern regions possess the largest explored balance resources of hard and brown coal: about 115 bn t of categories A+B+C_1 and above 55 bn t of category C_2. The hydro power potential of Russia's Eastern regions makes up above 640 bn kWh (75 percent of total Russia's) of which above 135 bn kWh (33 percent in East Siberia and 6 percent in the Far East) is already produced at hydro power plants. Electricity production in Russia's East in 2010 reaches 255-260 bn kWh at an internal demand of about 230 bn kWh. The difference makes up an export potential.

At the same time the largest countries in NEA (China, Republic of Korea and Japan) and major importers of energy resources are geographically very close to Russia [2] (Table 6).

TABLE 6. PRODUCTION, CONSUMPTION AND IMPORT OF FUEL RESOURCES AND THEIR PROVED RESERVES IN MAJOR NEA COUNTRIES IN 2009

Type of fuel, indicator	China	Japan	South Korea
Coal, m t:			
Production, m t	**3050**	**1.3**	**2.5**
Consumption, m t	**3019**	**202**	**130**
Net import, m t	**-**	**201**	**128**
Proved reserves, bn t	**114.5**	**0.4**	**0.1**
Oil m t:			
Production, m t	**189**	**-**	**-**
Consumption, m t	**405**	**198**	**104**
Net import, m t	**216**	**198**	**104**
Proved reserves, bn t	**2.0**	**-**	**-**
Gas, bn m^3:			
Production, bn m^3	**85**	**-**	**-**
Consumption, bn m^3	**93**	**86**	**34**
Net import, bn m^3	**8**	**86**	**34**
Proved reserves, tn m^3	**2.5**	**-**	**-**

It is rather interesting to have a look at the structure of primary energy consumption in these countries, Figs.1-3. With the local production considered the total share of imported primary energy resources in China in 2009 was 5 percent (first of all, oil), in Japan – 83 percent (oil, gas and coal) and in South Korea – 86 percent (oil, gas and virtually all coal).

For Japan and Republic of Korea import of energy resources is crucial now and will remain crucial in the future. Japan has worked out a program for prospecting and exploration of the shelf gas hydrate fields near its seacoasts, 12 hydrate bearing shelf areas contain 6 tn m^3 of methane. For the time being there is no commercial development of the gas hydrate fields. The presented data are indicative of an objective interest of NEA countries in supplies of hydrocarbons and electricity from closely situated regions of Russia.

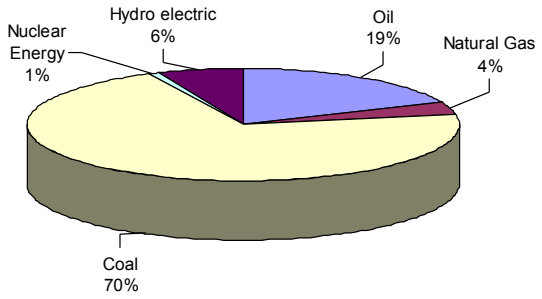

Fig.1. Structure of primary energy consumption in China in 2009

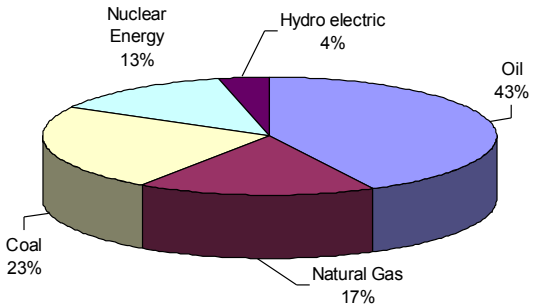

Fig.2. Structure of primary energy consumption in Japan in 2009

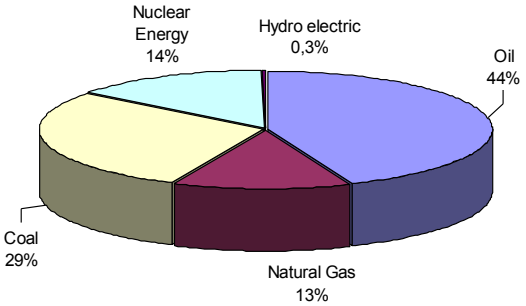

Fig.3. Structure of primary energy consumption in South Korea in 2009

There are good prospects for this cooperation and they are based on currently available projects for development of energy infrastructure to connect our countries (Figs. 4-6).

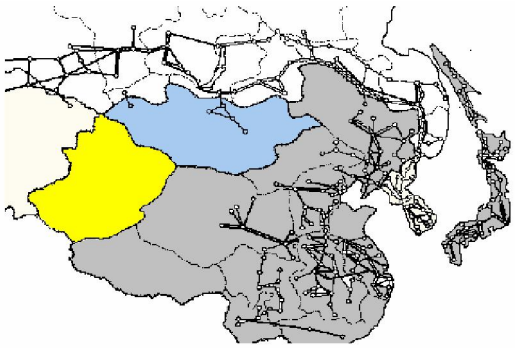

Fig.4. Main electric grid in the countries of Northeast Asia

Fig. 5. Gas supply system in Russia (existing) and in Asia (prospective)

Fig.6. A scheme of prospective main oil pipelines in Asia

The benefits to be gained by Northeast Asia through energy cooperation with Russia lie in the following:

- the economically beneficial balance of their energy supply will be ensured;
- the sources of hydrocarbon supplies will be diversified: Russia which is objectively interested in stable APR market for its oil and particularly natural gas will become another supplier along with the traditional suppliers - the countries of Persian Gulf, Africa and partly (gas) Southeast Asia and Australia. The hydrocarbon sources within Russia are also diversified (Irkutsk region, Sakha republic (Yakutia), Sakhalin Island);
- the structure of energy balances in the APR countries will be improved by the utilization of environmentally-friendly fuel (gas) of better quality and "clean" (for these countries) electricity;
- the companies from APR will have more opportunities to penetrate into the Russian markets for investment, equipment, technologies, other commodities and services;
- implementation of projects in the field of power industry will improve the reliability of power systems in the APR countries and reliability of power supply. Besides, other known "system" benefits from interconnection of power systems will be gained. The projects will make it possible to replace part of power plant capacities, particularly at thermal power plants in Japan, South Korea, and China, by the capacities constructed in East Siberia and the Far East of Russia that possess coal and hydro resources. The considered projects for interconnection of power systems allow the countries importing energy resources to diversify their import by electricity, since the failures to supply some types of fuel can be coped with by supplying electricity which will also improve energy security.

The benefits in terms of energy security of Russia and its Eastern regions are:

- the threat of investment deficit will be overcome through the expansion of opportunities to get funds for the development of Russian energy resources, first of all, in the Eastern regions, in the amounts sufficient not only to export the resources to APR but also to supply them to the internal markets, and for the creation of appropriate transportation and other infrastructures;
- expansion of opportunities to apply efficient technologies and equipment for upgrading and reconstructing the production facilities of fuel and energy complex;
- a new stable market for Russian energy resources will emerge;

- electric power industry will benefit from interconnection of power systems;
- employment of population will increase owing to the construction and subsequent maintenance of energy facilities and respective infrastructure.

The main negative factors to be mentioned as those hindering the mutually beneficial energy cooperation in the region are imperfect State energy policy on the Russian side and extremely politicized approach to solving practical problems on the side of some APR countries.

6. CONCLUSION

Over the last decade the world's consumption of primary energy has increased by more than 20 percent. The largest increase has been observed in the Middle East which is provided with local primary energy and in APR which suffers lack of these resources. Russia at the present time and in the long-term future can to a great extent affect the process of ensuring energy security, first of all, in the European and Asia-Pacific Regions. This requires that the current strategic threats to its energy security be combated. Energy cooperation in APR will be beneficial for the importing countries and for Russia. At the same time the extent of Russia's participation in ensuring energy security in the region should be tightly connected to its capabilities to meet the prospective domestic demand.

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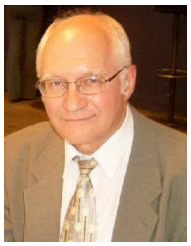

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