

Energy Sector of Kazakhstan: Current State and Prospects of Development

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Abstract: Fuel and energy complex largely determines the structure of the economy of Kazakhstan and is now the most influential factor of socio-economic development and integration into the global economy. The present stage of development requires a strategic view of the transformation processes in Kazakhstan and assessment of the passed and future steps. The Strategy of Industrial and Innovation Development of Kazakhstan for 2003-2015 provides for a sustainable economy development through the diversification of its branches, which include fuel and energy complex. The need for diversification is due to the increase of energy sector efficiency. To avoid a crisis, it is necessary to reform legislation with the view of changing the policy for energy resources use. It is very important for the country to develop the existing potential in the field of alternative energy, considering the world trend and to prepare a framework for the transition to renewable energy sources. In this case, oil production and refining remains the determinant industries in the world, but in the future, especially with the development of new technologies, the role of renewable energy sources will increase significantly. Kazakhstan has a great opportunity to reach a new level of economic development, if guided by the interests of the international community in this area and to establish programs aimed at strengthening the integration with other countries.

Key words: Fuel and energy complex • Energy sector • Oil production and refining

INTRODUCTION

Energy sector is important for the economy of Kazakhstan and is now the most influential factor in the maintenance of socio-economic development and integration into the global economy. The contemporary stage of development requires a strategic view to transformation processes in Kazakhstan with the assessment of the passed and future stages. The Strategy of Industrial and Innovation Development of Kazakhstan for 2003-2015 provides a sustainable economy by diversifying sectors, which includes the energy complex.

Production and consumption of energy resources is growing every year and the demand always outstrips supply, so the energy industry is the basis of the Kazakhstan economy, the most important source of export revenues. The control using energy resources is an important factor in determining the geo-political situation of any country. Because of competitive factors and consequences of the global financial crisis Kazakhstan in this period can not significantly increase the share of

industrial products in foreign trade. Exports of liquid hydrocarbons will be in the near future one of the main sources of foreign currency earnings and import financing, the second one is required not only to satisfy the needs of the economy, but also to ensure the development of industrial and agricultural sector by importing and using modern equipment and technology. It should be noted that due to the specific climatic conditions of the production of energy products in Kazakhstan three times higher than with the release of similar products in the European Community, which has a negative effect on the competitiveness of Kazakhstan goods and causes serious problems with its decline.

Analysis of Researches and Publications: The problems of the global energy including the development of the energy sector of the Republic of Kazakhstan is deeply investigated in the work of the President of the Republic of Kazakhstan Nursultan Nazarbayev [1]. The problems of efficient use of energy were investigated by scientists as M.G. Patterson [2], S.L. Freeman, M.J. Niefer, J.M. Roop

[3]. Efficiency of energy production and using innovations are studied by M.C. Connelly and J.A. Sekhar [4]. The development of the energy sector and its potential for future development in the works researched by D.Von Hippel and P.Hayes [5], D. Sundset T, G. de Koeijer [6], N. Lior [7], Noam Lior [8], Kae Takase, Tatsujiro Suzuki [9]. New Energy Policy in Europe are considered in A. Piebalgs [10]. The problems of development of energy sector in Kazakhstan and Russia are engaged by S.M. Mynbayev [11], K.K. Massimov [12], B.M. Mukhamediev, B.R. Syrlybaeva [13], K. Konyrova [14], D. Strebkov [15], E. Long, A. Scheulin [16].

Main Results. Production of Energy Resources: Today Kazakhstan is one of the countries that have huge reserves and have a significant influence on the formation and condition of the world energy market. In the territory of Kazakhstan opened 208 hydrocarbon fields, half of them-oil, a third-oil and gas and the rest-gas and gas condensate. Total forecast of raw hydrocarbon reserves in Kazakhstan with the potential of the Caspian shelf were 13 billion tonnes of oil and condensate and 7.1 trillion cubic meters of natural gas.

Kazakhstan can fully support yourself fuel and energy resources from its own natural resources and export of fuel and electricity from the republic. Coal production in Kazakhstan is 1.9 times greater than its consumption, production of oil is 8 times greater than its consumption [8].

To show the volume of production and consumption of energy resources in the world and in Kazakhstan, we conducted a comparative analysis. According to the agency British Petroleum production of energy resources in the world in 2011 was 10905.6 million tonnes (oil equivalent), in compare with 1991 increased by 52%, including coal production increased by 79% and

amounted 3955.5 million tonnes (oil equivalent); oil production was 3 995.6 million tonnes, an increased over the last 20 years by 26%, production of natural gas was 2954.8 million tonnes (oil equivalent), in compare with 1991 increased by 63% Fig. 1.

As for the energy production in the Republic of Kazakhstan, in 2011, their total volume was 2169,4 million tonnes (oil equivalent), including: coal production 58.8 million tonnes (oil equivalent), in compare with 1991 coal production declined by 12.2%, production of oil risen by more than 209% to 82.4 million tonnes, natural gas production increased by 169.5% to 17.3 million tonnes (oil equivalent) [BP stat].

Energy balance of Kazakhstan for 2011 showed that the country does not fully provide domestic energy needs, where the import share is 4.4% of the total volume of resources. In compare with 2010, production of energy increased by 2.1%, its share in resource part amounted to 89.7%. In the structure of the distribution of energy also has changed: the share of fuel and energy resources in the domestic market increased from 50.7% in 2007 to 54.2% in 2011 and decreased the share of energy exports from 40.6% to 38.4%.

Coal's share in the total volume of natural resources in 2007.-32.7%, in 2008.-33.6%, in 2009-31.7%, in 2010-32.5%, in 2011-33.5%. In the structure of coal resources the share of exports in 2007 was-27.5%, in 2008 to 27.7% in 2009-26.3%, in 2010-26.3%, in 2011-24.0% The share of the domestic market were as follows: 72.5%, 75.1%, 72.3%, 73.7%, 75.3%, 76.0% respectively.

Of the total resources in the domestic market, oil consumption was 15.5 million tonnes and exported 56.8 million tonnes. The oil market of the Republic continues to have raw material export orientation. Oil is exported mostly to Italy (25.9%), France (8.9%).

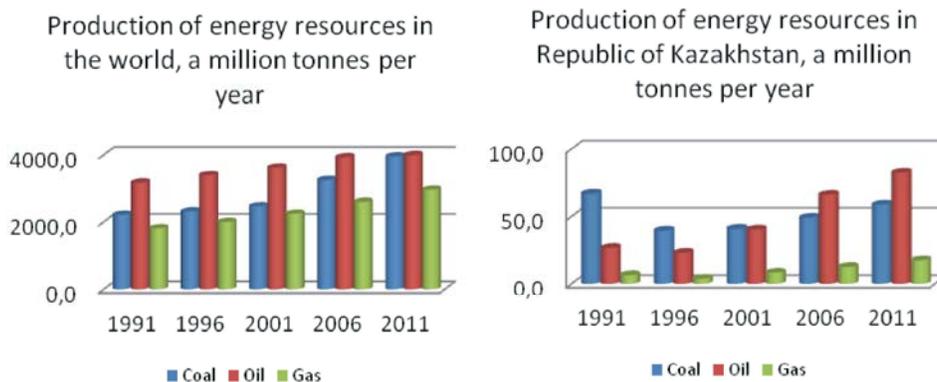


Fig. 1: Production of energy resources in the world and in Kazakhstan, a million tonnes per year.

In 2011 natural gas resources were provided by 63.1% of its own production and 27.2% by imports from CIS countries. There is a tendency to reduce the share of natural gas in total resources (from 23.4% in 2007. To 18.5% in 2011.).

Electricity production was in 2007-76.6 billion kWh, in 2008.-80.3 billion kWh, in 2009-78.7 billion kWh, in 2010-82.6 billion kWh. In 2011 exports to Russia amounted about 4.7 billion kWh. The electricity imported from Russia to western part of Kazakhstan and from central Asia-to southern part of Kazakhstan. Thus, to Kazakhstan imported 6.3 billion kWh of electricity, including 56.0% of it from Kyrgyzstan and 44.0% from Russia.

Electricity consumed in the domestic market of the country in 2011-73.1 billion kWh, which is 89.9% from total share of resources, in comparison with level of 2010 increased by 7.8%. Electricity losses in 2011 amounted to 7.8%. [11]

The uranium mining and manufacturing is an important part of Kazakhstan industry. In Kazakhstan concentrated about 19% of the world's proved uranium reserves. Its general resources amount about 1.5 million tonnes, of which 1.1 million tonnes is possible to extract by situ leaching method (ecologically and economically efficient method). Kazakhstan has volumes of extraction 20 thousand tonnes, which is 33% of the world production of uranium. For the whole period in the country produced only 4.2% of the total reserves of uranium. JSC "Kazatomprom"-the national operator of Kazakhstan for export of uranium and its compounds, rare metals, nuclear fuel for nuclear power plants, special equipment, technologies and dual-use materials. From 2009 Kazakhstan is the largest producer of natural uranium in the world. Uranium production in 2009 was 14 214 tonnes. Uranium output in 2010 amounted to 17 803 tonnes. In the uranium industry of Kazakhstan works many companies from Russia, France, Canada, Japan and China. At the end of 2011, the amount of uranium in Kazakhstan amounted to 19 450 tonnes, which is about 9% higher than the level of 2010. Kazakhstan supplies an uranium to all regions of the world where nuclear power plants in operation (Europe, Asia, USA). The volume of deliveries to customers on contracts amounted to 10 399 tonnes of uranium, or about 17% of world demand.

Energy Consumption: In 2011 energy consumption in the world amounted to 12274.6 million tonnes (oil equivalent), including: coal consumption was 3724.3 million tonnes (oil equivalent), increased to 71% in comparison with 1991;

consumption of oil was 4059, 1 million tonnes, in comparison with 1991 increased to 28%; natural gas consumption was 2905.6 million tonnes (oil equivalent), increased to 60.7% from 1991; hydroenergy consumption amounted to 791.5 million tonnes (oil equivalent), increased more than 58.1% than in 1991; nuclear energy consumption grew to 26.3% and amounted to 599.3 million tonnes (oil equivalent), the consumption of renewable energy sources has shown the highest growth at 553.6% and amounted to 194.8 million tonnes (oil equivalent) Fig. 2.

In Kazakhstan, the energy consumption showed different growth rates: coal consumption compared with 1991 decreased by 20.9% and amounted to 30.2 million tonnes (oil equivalent), oil consumption has decreased by 47% to 10.2 million tonnes, consumption of natural gas compared with 1991 decreased by 27.8% to 8.3 million tonnes (oil equivalent), hydropower consumption showed an increase of 12.5% to 1.8 million tonnes (oil equivalent).

Currently, most of the energy resources consumed directly as a fuel and energy 34.1%, while the consumption of them in a progressive direction is very low. Only 0.3% of the consumption of fuel and energy resources goes into producing petroleum and petrochemical products

At storage, processing and transportation of energy resources, is very noticeable loss of fuel, which approximately 32% of gas, oil-more than 29%, coal-13%. [20]

With increasing production and consumption volumes, the issue of energy resources in the world is very important. According to the Energy Watch Group, the world's reserves are estimated at about 1,255 billion barrels, which should be enough for 42 years. The United States Geological Survey in 2000 published own study, according that at the current rate of production of world oil reserves will be enough 50-100 years and the highest rate of world oil production will be reached to _ 2037-2040. Approximately the same estimates of reserves are formed from experts of British Petroleum (Table 1). Countries with the largest reserves determine the overall level of global oil resources. The first group of countries, which are lower than world average (46 years) are: the United States and China (11), Russia (20.1), Angola (21), Canada (28) which are maximally close to the depletion of its reserves. Another group with reserves above the threshold (46-100 years) constitutes: Nigeria (49), Qatar (55), Kazakhstan (65), Libya (73), Saudi Arabia (75), Iran (89). Finally, the most prospective and resourced countries are Kuwait (112), Iraq (127) and Venezuela (194). [9]

Table 1: The countries with the largest oil reserves

Country	Reserves, billion barrel	% of world reserves	Extraction of oil, th. per day	Ratio, years
1. Saudi Arabia	264,6	19,8	9713	75
2. Venezuela	172,3	12,9	2437	194
3. Iran	137,6	10,3	4216	89
4. Iraq	115,0	8,6	2482	127
5. Kuwait	101,5	7,6	2481	112
6. UAE	97,8	7,3	2599	103
7. Russia	74,2	5,6	10032	20,1
8. Libya	44,3	3,3	1652	73
9. Kazakhstan	39,8	3,0	1682	65
World	1333,1	100,0	79948	46

Source: BP Statistical review of world energy. 2010

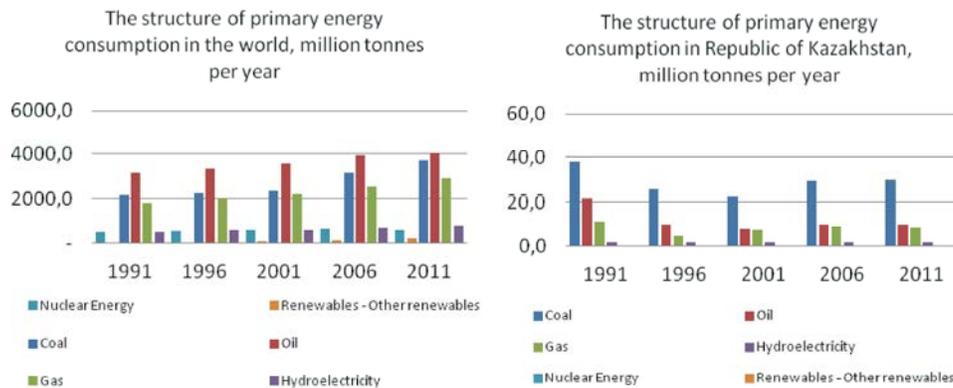


Fig. 2: The structure of primary energy consumption in the world and in Kazakhstan, million tonnes per year

With this level of hydrocarbon reserves, alternative energy sources are becoming more urgent. In this regard, in the developed countries increasing the use of alternative energy sources such as hydro, wind, solar energy.

Prospects and opportunities for renewable energy predicted in the near future shortage of traditional energy sources to generate energy flow sufficient for the economic and social development of developing and growing in number humanity makes a completely new way to look at the issue of renewable energy. Namely, not as a relatively small addition to the basic facilities but as a dominant energy source. This raises a number of new problems, including the problem sufficiency of potential of renewable energy sources and to find effective ways of their development. Opportunities for Kazakhstan on the use and development of renewable energy, particularly in the form of hydro, wind and solar energy are quite high, but weakly used due to the high cost of development. Development of renewable energy resources would be particularly effective for electricity generation at the local level, as well as for small dispersed loadings.

According to the British experts, 60% of the country have real opportunities for the development of alternative energy. This is enough to provide a significant part of the energy demand in Kazakhstan. At the same time, by increasing the use of alternative energy sources the country can increase the export of oil and gas and with predicted high world prices for hydrocarbons it will be very profitable [15].

Hydropower potential of Kazakhstan is estimated at about 170 TWh per year, but today is created only 8.7 TWh per year. Of great importance are small hydropower, which has a capacity of less than 10 MW. Studies show that for today, there are at least 453 potential small hydro section line with a total potential capacity of 1380 MWh and an average annual generation of about 6 TWh. Some of them involve the use of existing irrigation canals, which would require less input, resources and time to implement them. Kazakhstan is well-equipped for the use of wind energy, especially in the areas Jungar Gates and Chilik corridor, where the average annual wind speed of 7.9 m / s and 5.9 m / s accordingly. The proximity of the existing transmission lines, a good correlation of the season winds

to the growing need for electricity provide conditions for the effective use of resources. Kazakhstan is characterized by significant solar energy resources. Sunshine duration is 2200-3000 hours per year and solar energy kW/m² 1300-1800 year. This allows the use of solar water heaters and solar batteries, in particular portable photovoltaic systems in rural areas.

The total production of electricity in Kazakhstan based on renewable sources (including hydroresources) in 1990 amounted to 7.35 billion kWh per year, or 8.4% of its total production and 7% of the needs. Currently, the share of renewable energy sources is 0.3% of the total electricity, of which 90% are small hydroelectric power stations. In Kazakhstan in 2009 was produced 78.8 billion kWh of electricity. According to expert estimates, the structure of the overall economic potential of Kazakhstan without of hydrogen energy is next:

- Hydropower: theoretical potential of hydro energy-170 billion kWh per year, including the possible development of cost-30 billion kWh per year (2.57 million tonnes of oil equivalent).
- Solar Energy-2.5 billion kWh per year (0.21 million tonnes of oil equivalent).
- Wind power: theoretical potential capacity is estimated at more than 1.8 trillion kWh per year of economic opportunities-3 billion kWh per year (0.26 million tonnes of oil equivalent).
- Processing of agricultural wastes are 35 billion kWh of electricity and 44 million Gcal of thermal energy (7.42 million tonnes of oil equivalent). Thus, the current estimate of the total economically significant potential of renewable energy sources in Kazakhstan is estimated at 10.46 million tonnes of oil equivalent.

In Kazakhstan intensively developing renewable energy. From 2012 to begin commercial production of 50 thousand tonnes per year of polysilicon for the solar industry, formed large projects in wind power (Dzungarian gate, Shelek corridor, Yereimentau, Astana, Fort Shevchenko, Atyrau, Arkalyk, Korday) [10].

The international community is taking active measures to increase the share of renewable energy. The European Union has committed gradually increase the share of renewable energy from 6% to 20% by 2020, while the share the use of biofuels for transport-at least up to 10%. It means that in 2020, one-fifth of the energy and one tenth of the fuel consumed in the European Union, will be from non-hydrocarbon resources. According to the forecasts of the World Energy Council to 2050 also

provides for doubling the share of renewable energy use (from 20% to 40%) in the total energy production. The United States, Brazil and Europe, are likely to be leaders in the use of bio fuel [12].

Development of the energy sector is the basis for the solution of all economic problems, so in Kazakhstan's energy policy should include the following organizational and economic measures:

- strengthening of material and technical basis of energy sector and related industries by increasing highlight the material and financial resources for development;
- Improving the distribution of productive forces of the country in a direction closer to the consumers of fuel to the main fuel and energy bases in Kazakhstan;
- Development of of market mechanisms to regulate the production of the fuel and energy complex;
- development of different ways of transportation of energy resources from areas of the North-West, South-West and North-East Kazakhstan will be provided where the main increase in oil production (gas, coal, etc.) [13].

With the globalization processes of the world economy and to increase energy security is necessary to form an autonomous power system, organize process its own fuel raw materials to finished products. The development of electric power industry in Kazakhstan should be conducted on the basis of their own traditional and alternative sources.

Kazakhstan Today-one of the countries with the richest reserves of oil, gas, uranium and , at the same time conscious of that the used fuel at a faster pace, not only reduced, but can also lead to environmental degradation.

In the current situation in the global energy sector is currently a complete rejection of traditional energy sources is impossible. According to forecasts of OPEC secretariat (World oil outlook) for the period 2010-2035, primary energy demand in the reference case increases by 54%. Fossil fuels currently account for 87% of this will continue to do up to 82% of the global total by 2035. For most of the projection Period, oil prices remain energy type with the largest shares. To end of the forecast period the use of coal in the baseline scenario reaches the same level as the oil, the share of oil fell from 35% in 2010 to 27% by 2035, but the demand will increase reaching 107.3 mb/d by 2035. The use of natural gas will be growing at a faster pace than any coal or oil, as a percentage. Conditions and volumes, with its share increase from 23% to 26%. [20]

Therefore, Kazakhstan plans to increase oil and gas production. According to the Minister of oil and gas S. Mynbayev oil production in 2020 will be 132.1 million tonnes, natural gas 92.2 billion cubic meters. The country has created favorable conditions for development of the oil and gas sector [11].

Given the importance of energy and environmental issues, the Republic of Kazakhstan the international community are subject to the exhibition EXPO-2017 "Energy for the future." This theme will highlight the problem of energy saving widely and promoting alternative energy sources such as solar, wind, energy, marine, ocean and geothermal waters, which these days is becoming increasingly important for countries around the world. Theme of "Energy Future" will be the same for all mankind and help solve global problems of environmental threats and lack of energy.

CONCLUSIONS

- At present, in the world the structure of the energy sector is changing and the world's demand for energy resources increasing. Reserves are exhausted. The ratio of production and reserves changes, it creates problems in the future energy consumption.
- Kazakhstan is a country rich in natural resources—particularly oil, natural gas and coal and has a problem of resource based economy. At the moment in the country implementing a new strategy to create conditions for developing energy sector.
- Kazakhstan has a great capacities to alternative energy development and in accordance with the global trend, is preparing the foundation for the transition to renewable energy sources..
- Despite development of renewable and nuclear energy, world statistical agencies make predictions that oil remains one of the main sources of energy in the near future. The Kazakhstan intends increase oil production and environmental security of energy sector.

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