THE FACTORS IN THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES IN THE REPUBLIC OF KAZAKHSTAN

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The article is devoted to the factors contributing to the development of renewable energy sources in the Republic of Kazakhstan. The international practice of development of alternative energy sources in ecology, increase in prices for the electric power and deficiency of energy consumption was analyzed. The negative consequences on the environment and the human body from the functioning of energy enterprises were indicated. The dynamics of growth in the tariff for electricity was analyzed.

Keywords: *environmental factor, renewable energy sources, energy deficit, energy sector, fuel and energy resource, energy*

Increase of interest in use and development of renewable energy sources is connected with the aspiration of today's world to solve primarily environmental problems facing mankind. The universal obligation to reduce greenhouse gas

emissions and existing factors are currently driving the development of renewable energy sources (RES) in the world community and in Kazakhstan.

Factors contributing to the development of RES in Kazakhstan

Ecological factor

Development of renewable energy sources in the solution of the problem of climate change is proposed as an alternative. As a result of human activity, there was a significant increase in the concentration of greenhouse gases in the atmosphere. Such increase will lead to additional warming of a surface and atmosphere of Earth and can make an adverse effect on natural ecosystems and mankind. The largest share of global greenhouse gas emissions falls on developed countries. It will increase in developing countries in connection with satisfaction of their social needs and needs for development [1].

Energy-producing enterprises interact with the biosphere, i.e. with air, water, soil, vegetation, etc. It is difficult to foresee and evaluate all the negative effects on the environment from their activities. The consequences of impacts affect all elements of society. Pollution, entering the atmosphere, water, soil, certainly have an effect on the human body, causing various diseases. Together with the smoke emitted into the air sulfur and carbon dioxide. The combined presence of pollutants in the air in the production process increases the toxicity of these substances on the environment and human health, i.e. the effect of summation. The summation effect is one of the hazard characteristics of pollutants emitted into the atmosphere by emission sources. The toxicity of impact of these substances on a human body and the environment increases at their joint presence at atmosphere air.

Each of these pollutants has a negative impact on human health and forms a photochemical fog (smog). For example, nitrogen dioxide causes bronchitis, decreased resistance to respiratory diseases, and lead to pulmonary edema. A sulfur dioxide acidifying the soil, leads to an exacerbation of human respiratory diseases. Oncological diseases, infertility and congenital pathologies cause especially

dangerous dioxins. All of them not only affect the respiratory tract, but also affect the respiratory system, skin, central system and cancer [2].

The ecological situation is aggravated by the world production of fossil fuel and energy complex (FEC). Analytical research and literature review indicates an increase in the use of these sources. Until 2030 there will be a significant increase in coal, gas and oil.

Table 1- Current state and forecast of the structure of the world production of fossil fuel and energy resources

Source	Peace		2030. in % to 2004
	2004	2030	
Oil, mln b.	83,6	116,3	139,1
Gas, mln. м3	2784	4663	167,5
Coal, mln.т.	5559	8858	159,3

Source: IEA Word Energy Outlook 2006,Reference Case

World production of fossil energy resources in the world is growing. The smallest growth rate is inherent in oil on 39,1, %, and the greatest gas for 67,5%. There is a dependence on solid fuels of world production, which will continue in the period under review, even in the case of an active policy to replace oil consumption (tab. 2).

Table 2 Current state and forecast of the structure of global consumption of fuel and energy resources with an active policy to replace oil consumption.

Fossil energy resources	Years, в mln.			Share by years, in%			2030. in % to 2004
	2004	2015	2030	2004	2015	2030	
amount	11204	13537	15405	100	100	100	

Coal, mln.т.	2773	3431	3512	25	25	23	0,92
Oil, mln b	3940	4534	4955	35	33	32	0,91
Gas, mln. м3	2302	2877	3370	21	21	22	1,05
Nuclear power plants	714	852	1070	6	6	7	1,17

Source: IEA Word Energy Outlook 2006,Reference Case

By 2030, world consumption of coal and oil will decrease only by 8% and 9%, respectively. At the same time, an insignificant increase in gas is expected to be 5% and uranium 17%.

Coal generation generates most of the electricity in the world. A major producer (45.5% of world production) and importer of coal, China has a higher specific emissions of harmful substances than other types of generation. Radioactive pollution of the environment by coal-fired power plants is stronger than by nuclear power plants (NPPs) of the compared capacity. At combustion of coal they almost completely get to the external environment [3]. CO2 emissions from coal - fired power plants are 969-1190 g/kWh for brown coal, 898-952 g/kWh for stone coal, and 398 – 544 g/kW*h for natural gas [4].

In the Republic of Kazakhstan, more than 70% of the energy is generated by coal-fired power plants. The dependence of energy on coal remains due to the adopted Program of development of the Unified energy system and the sufficient availability of coal deposits in the Northern and Central region. The significant difference in the specific standards of air emissions in Kazakhstan in comparison with the European countries (EU) and the Russian Federation (RF) (Table 3) confirms the high concentration of harmful substances in the combustion of various fuels in boilers of thermal power plants in our country [5]. And also revision of norms after 2016 in the European countries demonstrates strict control in environmental issues.

Table 3- Technical specific standards of emissions in the atmosphere of the Republic of Kazakhstan, European Union and Russian Federation

The name of the indicator	Concentration of pollutants in flue gases, mg / Nm3.		
	NOx	SO2	Ash
Emission standards of the Republic of Kazakhstan for power boilers introduced in 2013	570	780	100-200
EU emission standards for boilers introduced: - until 2016 - after 2016	 500 200	200	30
Emission standards of Russia, for boilers introduced since 2003	350	700	150

Source: Resolution of the Government of the Republic of Kazakhstan No. 1232 of December 14, 2008. "Requirements to issues to the environment at burning different types of fuel in coppers of thermal power plant".

As well as the revision of the regulations after 2016 in European countries indicates a tight control in environmental matters. Currently, the excess of the normative indicator of pollutants in Kazakhstan compared to Russia is about 30%, and with the EU - more than 3 times.

Deficiency of energy consumption.

The problem of energy shortages still exists in developing and developed countries. Despite the export of hydrocarbon raw materials there are energy-deficient regions. In Kazakhstan, the South, West and East regions of the country face energy shortage. There is a similar problem in Russia, such as districts are forced to pay a high price for mains connection [6]. Japan practically has no own energy resources. On import of consumed gas takes first place and the fourth largest in terms of energy consumption in the world at a consumption level of about 80 billion cubic meters per year [7].

Now the modern way of life and structure of economy of the developed countries demands electricity consumption not less than 5000 kWh per capita, for developing - 2100 kWh, but due to the increase in living standards by 2030, the latter

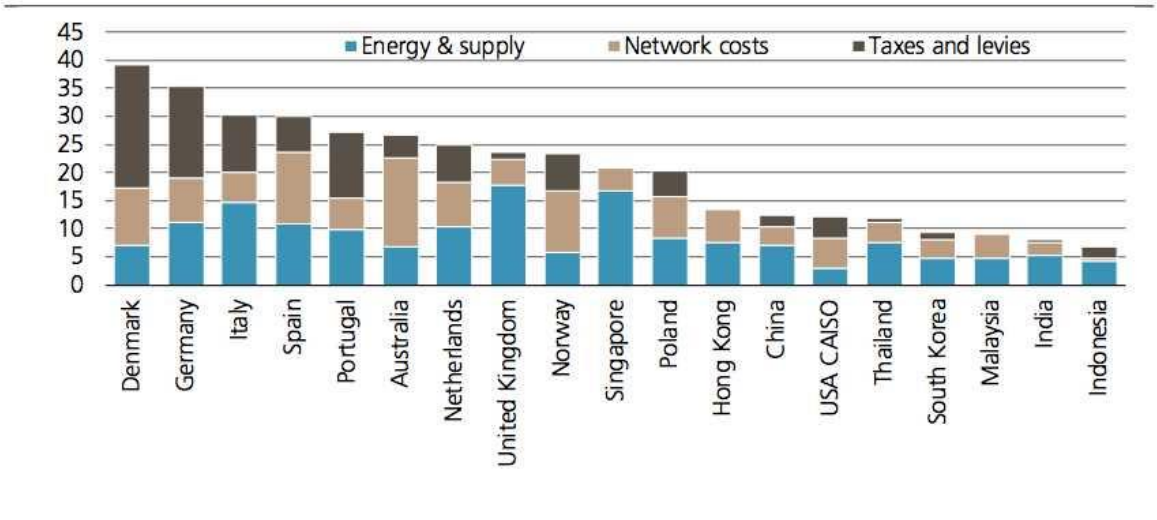
figure may rise to 5000 kWh. As a result, the share of electricity consumption in developing countries will grow to 52-56% by 2030, and by 2050 to 56-69% [8].

It is necessary to take into account the fact that the limitation of the possibilities of generation and delivery of electricity to end users has a significant deterioration of capacity. That is one of the reasons for the consumption of the most transmitted electricity. According to international experts in the field of energy, the relative loss of electricity during its transmission in electric networks should not exceed 4 %. Losses of the electric power at the level of 10% can be considered the most admissible [9]. We have quite long networks from 500 to 1500 km between the centers of consumption and generation, the losses in the main networks are 20-30 % [10]. Exceeds the world average loss level in Russia, where the longest electric networks are more than 2 million km long [11].

Increase of prices for energy resources.

In Europe, the reasons for high prices and the transition to alternative sources are the dependence on energy sources (coal, gas, oil, and uranium), the tax burden and the "floating" costs of generating companies. The company UBS analyzed the comparison of electricity tariffs in the world and their sharp rise in many countries in recent years (Figure 1).

Figure 1: 2013 tariffs (US cents per kWh)

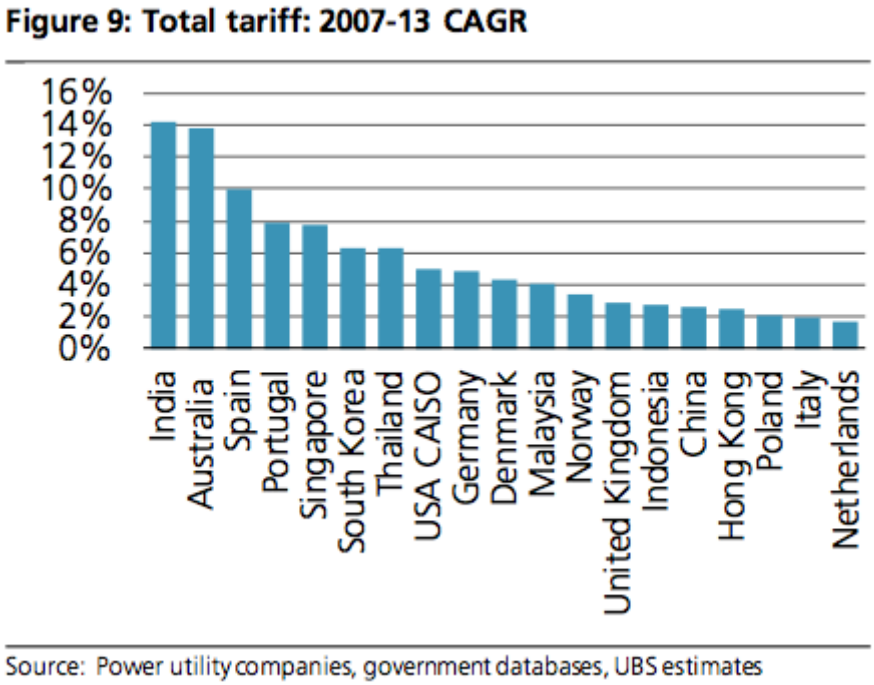


Note: Residential tariffs for Australia, Europe and the US; national average for Asian markets.
Source: Power utility companies, government databases, UBS estimates

Source: [http://energosberejenie.org/analitika/povyshenie-tarifov-na-elektroenergiyu-v-mire]

Figure 1 Tariffs for electricity in the aggregate ratio for 2007-2013.

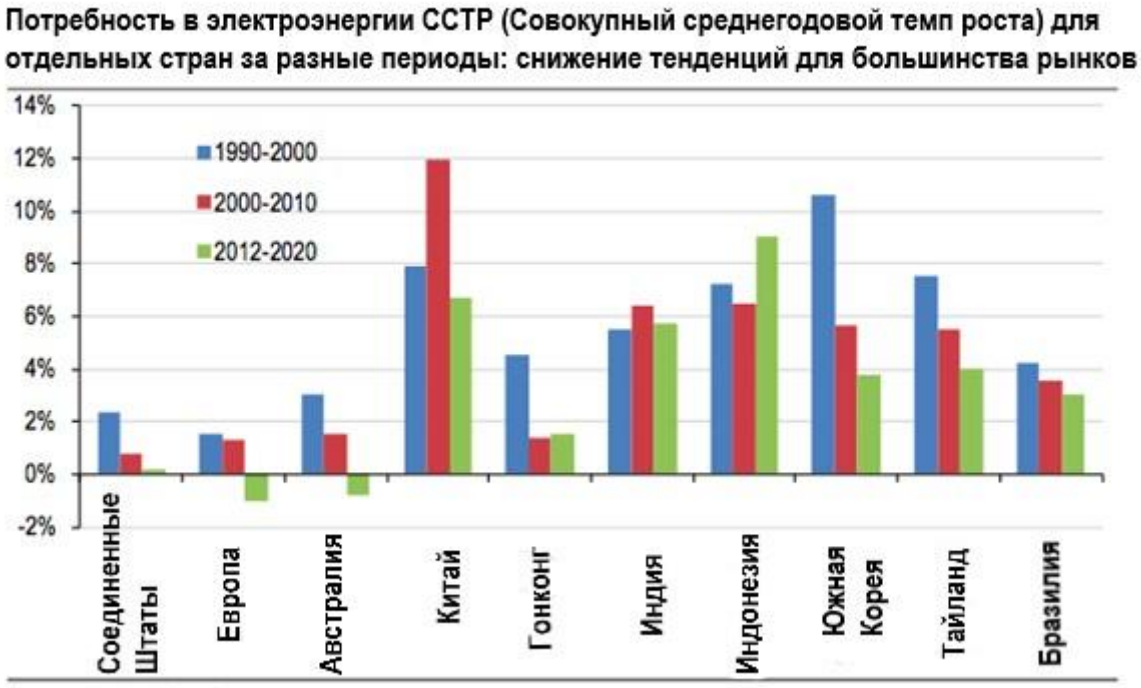
The leader is Australia. The average cost here is more than $ 0.15 kWh, almost 50 percent more than that of the closest rival Spain, and three times more than in Germany and Denmark. The reasons for this demand in Australia are the network costs, as in Spain and the United States. On average, in developed countries, wholesale electricity prices fell slightly from the level of the world average due to the use of renewable energy sources, which caused a decline in demand. In the countries with developing economy on the contrary, there is an increase due to additional costs of fossil fuel imports and increased demand. Countries with developed energy based on renewable sources include Denmark, Germany, Spain and Portugal. At the same time, in Germany and Denmark, the average growth rate of electricity prices for 7 years is much lower than the average, despite the fact that these countries spend significantly on the promotion and use of renewable energy sources (figure 2).



Source: [http://energosberejenie.org/analitika/povyshenie-tarifov-na-elektroenergiyu-v-mire]

Figure 2. Average growth rates of electricity prices from 2007 to 2013

It is necessary to take into account the fact that most of these countries already had high prices in connection with the agreement to import expensive fossil energy resources. The demand for electricity over the last two decades is shown in figure 3.



Source: [http://energosberejenie.org/analitika/povyshenie-tarifov-na-elektroenergiyu-v-mire]

Figure 3. Demand for electricity during the period from 1990 to 2020.

Almost in all countries with developed economy during the period from 1990 to 2000 there was an increase in demand for electricity. The highest 11% is in South Korea and respectively low about 2% in Europe. In the next ten years till 2010 the need for the electric power grew in China by 12% when it fell in the USA (about 1%). Up to 2020, an increase is expected in Indonesia. And in the rest there is a fall. Foreign price policy is aimed at establishing a stable electricity price. The energy policy of the United States for 45 years, provides a stable price for electricity for its industry in security of energy supply, keeping energy costs low and protecting the environment. It belongs also to the European countries. Developed countries understand the impact of energy on the economy is great. To support and increase economic growth, stable energy prices are needed [12]. In Russia, due to the constant

lack of investment in the energy sector, energy prices increased many times, as a result, the prices of energy increased by 3 times. However recently in economy negative processes are shown: the growth of GDP of industrial output and investment in fixed capital is hampered [13].In the markets of countries with a significant share of RES, there is a decrease in average electricity prices [14].

In Kazakhstan, electricity tariffs are increased from year to year due to the operation of power plants on the principle of "tariffs in exchange for investment". There are few investors in the industry, so they must borrow or use their own funds to implement projects. In 2009, the Government of the Republic of Kazakhstan adopted the "Program on the phased increase of marginal tariffs for 2009-2015" to create an effective balanced system for regulating the activities of natural monopoly entities. According to Kazakh energy monopolists "The increase in tariffs is necessary to maintain and modernize assets, ensure the quality of services and develop the economy" [15]. In the dynamics of the tariff for thermal and electric energy of traditional TPPs served on coal, the same increase is observed (fig. 3).

Table 4. Dynamics of tariff growth for thermal and electric energy from 2013 to 2015

Rate	2013	2014	2015	Change (+;-) 2015 to 2013
Thermal energy, in tons / Gcal.	1071	1238	1238	+167
Electric energy, in tg / kW	5,74	6,62	7,3	+1,56

Source: [http://www.kegoc.kz/ru]

In 2016-2017, the tariff for electricity generated from thermal power plants increased by 0.2 tenge /kWh. At the same time, considering the insignificant share of renewable energy sources in Kazakhstan, it is too early to expect a decline in energy prices.

Thus, in the development and use of renewable energy sources in the Republic of Kazakhstan, it is necessary to take into account the identified factors that determine the future of the country's energy.

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