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### **Atyrau region current energy status**

This study is devoted to the research of the current state of Atyrau region's energy and efficient energy supply, to use in everyday life by producing alternative sources of energy, which is valuable in terms of technological innovation in the energy industry in the region. Currently and in the foreseeable future the most important energy resources will remain hydrocarbons, because oil and gas are the raw materials which determine the kind of fuel, mineral and synthetic materials. Because of these properties, they will be stable and long-term in leading the global energy balance. According to the most expert estimates, the share of hydrocarbons in the nearest future will not fall below 80 % and the highest demand for this resource leads to an increasing transformation of international relations from the geopolitical territorial claims to control over zones of oil and gas deposits and transport routes. Nowadays electric power complex is characterized as a highly capital-intensive and initiative. Therefore, a set of measures for the development of electric power is required, so that it won't be the «bottleneck» in the economy, stopping the development of the region and the country at all and to be competitive in terms of integration into the world economy.

*Keywords:* energy, power supply in the region, transport electricity, hydrocarbon raw materials, energy and mineral resources, the basic sectors of the economy.

In modern society, energy issues are very important. This area has a special impact on the livelihoods of State and affects almost all areas of human existence. Today, energy has become the basis for the development of scientific and technological progress and the productive forces of the basic sectors of the economy - industry, agriculture and transport. It is also an integral part of everyday life and social well-being of people's livelihood, to develop the living conditions and activities of the population.

Problems of energy development, the development of energy policies aimed at energy conservation and the development of modern technologies of alternative fuels production involved many Western scientists Dzh.Hartik, E.Storms, P.Hagelshteyn, T.Loder, Russian scientists A.V.Lemeshko, A.V.Frolov, V.D.Dudyshev, V.Sobolev, A.I.Lukashov, Kazakhstani scientists K.Dukenbaev, B.K.Sultanov, A.V.Bolotov et al.

K.Dukenbaev leading specialist of the country proposes in his research to use the achievements of the world energy system in the implementation of international standards for the production and distribution of electricity to consumers to ensure a reliable power supply to consumers. He considers the problem of maximum energy savings due to the introduction of the latest equipment and the replacement of existing equipment on higher technology in all sectors of the economy to meet world-class standards. His studies indicate principles of technical and economic parameters in the power industry and the role of government in stimulating the development and implementation of energy saving policy. He points out that one of the most important mechanisms for the implementation of energy policy is the formation of the wholesale energy market and the creation of business entities, effective use of natural resources, providing all the energy consumers with the safe energy and implement policies to create clean and safe energy [1].

Kazakh scientists B.K.Sultanov, AV Bolotov et al. Investigated the problems of the global energy and Kazakhstan's experience in energy security [2].

The methodological basis of the study is the dialectical method of recognition. The study used scientific methods such as analysis, synthesis, systematic approach, as well as a special statistical method of recognition.

Atyrau region – is one of the most dynamically developing regions throughout Kazakhstan. There is a growing electricity consumption in the regional center, and in areas where hundreds of new homes being built. If the average annual growth of electricity consumption is 5-6 per cent in the whole country, it is not less than 8-9 per cent growth in Atyrau this year [3].

Therefore, some of the priorities are energy supply and energy efficiency. The region has developed a program of modernization and development of energy field and the creation of new capacities, for example - is an extension of the Atyrau CHP. This project is important not only for the region but for the whole of Kazakhstan, because it works on the energy security of the whole country. The fourth stage of the heat-power

plant with the installation of the first turbine capacity 25MW per year is under construction. Start of the turbine - the first stage of the investment project of expansion of the Atyrau CHP. Simultaneously, the CHP conducted installation of two more turbines with a capacity of 25 MW each. After completion of the project capacity of the Atyrau CHP will increase by about 75 MW per year, which will allow the region to abandon the purchase of electricity from neighboring Russia and Mangistau, where until the area has to buy 10-12 percent of its electricity [4].

For the purpose of insurance is under constant development of possible emergencies in parallel with Russia and Aktau. This scheme adopted for reliability in the energy sector. In the event of an accident - help MAEK Mangistau and Russia. To do this, there is interconnection line of 220 kilowatts. But Atyrau CHP generated electricity can't reach the consumer. In Atyrau, the problem is not a lack of energy, it's on their delivery. Part of the electricity networks, transformer substations actually developed a life of work and at the last limit. The problem is that the main electricity power «AtyrauZharyk» were put into operation in 50-70<sup>th</sup> of the last century and, of course, can't provide reliable and uninterrupted power supply of Atyrau city and Atyrau region. Especially considering the construction of new facilities housing purpose, social infrastructure, development of small and medium-sized enterprises, the growth of oil production and transportation [5].

It should be noted that the condition of fixed assets as a result of prolonged use and normal wear and tear, obsolescence and aging equipment and electrical networks is typical not only for the Atyrau region, but also for all regions of the country. Yes, and not only in Kazakhstan, it is a trouble of all post-Soviet countries.

Consideration that the electricity should develop faster than other sectors of the economy, to ensure their requirements in power, importance of electric power source development and their delivery is in place. This is reflected in the Law «The Electric Power Industry» and in a number of Government of the Republic.

In other words, this is another step towards ensuring energy security of our country.

Energy conservation - is the implementation of a complex of targeted projects designed to scientifically based reduction in energy use in material production and the social sphere, used as a means to reduce the energy intensity of the national income.

In order to achieve short-term or long-term decrease in the intensity of energy consumption, it is necessary specifically to manage and control energy consumption, increase energy prices to world levels equivalent and introduce new practices and technologies, as well as government energy-saving program [6].

The experience of individual industrial enterprises shows that the implementation of short-term and medium-term energy saving projects resulting in energy savings of 15-20 %. To achieve long-term projects energy savings can be achieved by the introduction of more advanced, new technologies, as well as the necessary time to the state of the program and the increase in energy prices growth given the full positive effect.

Atyrau region is located in the harsh natural and climatic zone, soil salinity rapidly wears engineering networks. At the moment, the overall deterioration of the infrastructure of utilities - 50 %, the physical deterioration of municipal water supply networks - 50 %, sewerage networks - 60 % of heat networks - 80 %, electricity networks - 50 %, gas lines - 29 %. Due to leakage and unaccounted for water flow in water systems initiates' shortage of water that carries the inefficient use of natural resources. All of these drawbacks lead to deterioration of the network.

At the moment, the city of Atyrau and Atyrau region is supplied with electricity from the Atyrau CHP and receives power through the networks of JSC «AtyrauZharyk» from Russia and Mangistau region.

CHP of JSC «Atyrau Refinery» provides electricity for Atyrau refinery.

LLP JV «Tengizchevroil» (TCO) receives electricity from the gas turbine power plant GTS-144 and GTS-480, which completely cover the object needs.

The average tariff for electricity through the networks of JSC «AtyrauZharyk» is 6.0 KZT / kWh. h (without VAT).

In the future time Atyrau city and Atyrau region plans to receive electricity at the expense of all the same Atyrau CHP and receive power through the networks of the regional Grid Companies (REC) of North Kazakhstan and Mangystau oblast according to agreements with the supplying organizations selling consumers generated or purchased electrical energy (IRB).

*Energy Status field, includes power equipment of power stations, electric and heat networks.* According to the analysis and evaluation of the technical condition of overhead transmission lines and substation equipment for the Atyrau region, the following data was received:

1. Electrical networks and cable lines 0.4 kW are worn by 54 %.
  2. The deterioration of electrical networks and cable lines 6/10 kW is 28 %.
  3. Electrical networks and cable lines 35/110 kW worn by 25 %.
  4. Depreciation of substations of 35 kW and above 30 %.
  5. Depreciation of transformer substations and distribution points - 49 %.
- The total length of heating networks - 193.332 km, including:

- Trunk - 37.642 km;
- Distribution - 12.545 km;
- Intra - 143.145 km.

In order to achieve an optimal hydraulic regime of heating networks are installed pumping stations, such as:

- pumping station №1 capacity of 1620 m<sup>3</sup> / h with the installation of pumps for the reverse network link;
- pumping station №2 capacity of 2400 m<sup>3</sup> / h with the installation of pumps for forward and reverse network link.

*Sources are covering electrical loads.* Power and energy balances. As mentioned above, the power supply for consumers of Atyrau region Atyrau CHP engaged in and the city receives power through the networks of JSC «Atyrau-Zharyk». Gas turbine power plant GTS-144 and GTS-480 supply electric power only objects Tengizchevroil (TCO) without issuing in the surrounding areas of the region. Installed and available power plants are given in Table 1.

Table 1

**Installed and available capacity of power plants, MW**

Name of power station	Accessory	Type of fuel	Installed capacity	Power Distribution
GTS-144 (4h34 MW)	Tengizchevroil	Gas	136	128
GTS-480 (2h34 MW)	Tengizchevroil	Gas	110	110
Total			246	238
Power stations in the city including:	JSC «Atyrau CHP»	Gas	227	202
- Atyrau CHP	JSC «AOR»	Masut	215	190
- CHP AOR			18	18
TOTAL for Atyrau region's power stations			479	446

*Note.* The table uses data from electronic resource <http://ri.search.yahoo.com/>.

In the period until 2020 it is planned to introduce new own capacity of approximately 920-1050 MW projected for the growing load of oil and gas facilities. To cover the remaining loads promising consumers the area is planned to build three gas turbines with a capacity of 25 MW each on the Atyrau thermal power plant. It is also planned to build a gas turbine power capacity of 90 MW.

Power «Tengizchevroil» LLP (TCO) are developed on the basis of elaborations on the «Chart of the external power supply of the second generation plant and power connection scheme (2x120 MVA) TCO», according to which the upgraded GTS-480 with extension units № 7 capacity of 43 MW and the construction of gas turbine power 240 MW units 2hGT-120 for power supply of the second generation plant.

Additional gas turbine power plant is presented in the amount of power required to meet the electrical load of the Kashagan field and other oil fields in Atyrau region in accordance with the projected volumes of oil according to the Department of the Ministry of extraction of energy and mineral resources of RK.

Future balances of power and energy for the period up to 2020 drawn up to identify the minimum and maximum levels of energy consumption and electric loads in the tables [7].

The balance of power Atyrau region as a whole in line with the increase in the electrical loads and the development of power plants is given in Table 2.

Because of the limited local budgets and inability to provide the all required tools outdated production assets keep increasing annually in utility companies, engineering networks are becoming unusable, the quality of services become wearied, which increase their recovery costs. Amount of the allocated funds aren't sufficient for a complete reconstruction of the utilities sector.

Table 2

**Production of electrical and thermal energy, starting in 2010,  
by species and forecast to 2030 by JSC «Atyrau CHP»**

Name	Unit	2010 y.	2015 y.	2020 y.	2030 y.
Electricity generation	Million kWh	1500	1750	1950	1950
The annual heat supply	Thousand Gcal	950	960	965	965
Annual consumption of natural fuel, Total:					
Masut	t.n.t.	4000	4000	4000	4000
naturalgas	thousand cube meters	609386	664175	726623	726623

Poor financial condition of municipal services is largely due to the mismatch of tariffs on actual costs of services production. Acting now tariffs do not allow to carry out the break-even activity of the municipal sector. SWOT-analysis allowed to identify strengths and weaknesses in the energy sector (Table 3):

Table 3

**SWOT-analysis of the strengths and weaknesses of the energy sector**

<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>• a high level of production of electric power by thermal power plants using cheap coal (about 74 % of total production);</li> <li>• development schemes backbone transmission lines with voltage 220-500-1150 kV;</li> <li>• a centralized operational dispatch management system;</li> <li>• high potential for renewable energy (in excess of 1.0 trillion kWh.);</li> <li>• cooperation with the ECO UPS Kazakhstan and Central Asia ECO Russia;</li> <li>• formation of the legal framework for the effective operation of wholesale and retail market of electric and thermal energy;</li> <li>• the ability to export electricity and the availability of transit potential of the country;</li> <li>• Large amount of stocks of fuel and energy resources.</li> </ul>	<p><b>Weakness:</b></p> <ul style="list-style-type: none"> <li>• limiting production of economic life of the generating equipment that limits the power generation capabilities of existing power plants as well as in the national thermal power remaining economic life is between 20-30 %;</li> <li>• shortage of generating capacity maneuver to cover peak loads due to the low share of hydropower plants (about 12 %) in the structure of generation capacity;</li> <li>• uneven distribution of generation capacity, inherited from the Soviet period;</li> <li>• a high degree of deterioration of the electrical network of regional power grid companies, about 65-70 %;</li> <li>• noticeable weakness mechanism to ensure the construction of new power plants;</li> <li>• dependence of the western zone of the Unified Energy System of Kazakhstan, West Kazakhstan and Atyrau regions of electricity supplies from Russia in connection with the range due to the UES of Kazakhstan.</li> </ul>
<p><b>Capabilities:</b></p> <ul style="list-style-type: none"> <li>• accession of the Western area to the main part of UES of Kazakhstan;</li> <li>• ensuring energy security for the individual regions;</li> <li>• the introduction of a capacity market;</li> <li>• a self-sufficient supply of domestic energy resources of the region;</li> <li>• an increase in export and transit opportunities of the republic;</li> <li>• Measures to increase the investment attractiveness of the power sector in order to attract investments in the power industry.</li> </ul>	<p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>• increase the gap between the available capacity and the installed capacity and disposal of the main equipment at existing power plants;</li> <li>• growth of not covered power shortage;</li> <li>• the continued dependence of the country's electricity from neighboring countries.</li> </ul>
<p>The table is for an electronic resource data: the needs of the economy of Kazakhstan in energy. <a href="http://gossmi.ru/page/gos1_545.htm">http://gossmi.ru/page/gos1_545.htm</a></p>	

From the information that given in the table shows that the balance of power in the Atyrau region in 2005–2020. It added to the growing deficit, which is expected in the range of 73-250 MW for the minimum and 93-340 MW at maximum options (Table 4).

Table 4

**Power Balance in Atyrau region, MVatt**

Name	2008 y.		2015 y.		2020 y.	
	Min	Max	Min	Max	Min	Max
Need						
1. The maximum electrical load (Own)	740	820	1140	1400	1350	1560
Covering						
1. Existing power plants	1135	1135	1283	1435	1385	1515
2. Used in the balance of power capacity	660	700	980	1160	1100	1220
3. Deficit (-) Excess (+)	-80	-120	-160	-240	-250	-340

The table uses data from electronic resource <http://ri.search.yahoo.com/>

Demand for energy, which includes electricity and heat up to 2030 are given in Table 5:

Table 5

**Production of electricity and heat, starting from 2010 by type  
and forecast up to 2030, at the JSC «Atyrau CHP»**

Name	Unit	2010 y.	2015 y.	2020 y.	2030 y.
Electricity generation	Million kWh	1500	1750	1950	1950
The annual heat supply	Thousand Gcal	950	960	965	965
Annual consumption of natural fuel,					
Masut	t.n.t.	4000	4000	4000	4000
Gas	Thousand cube meters	609386	664175	726623	726623

For the rational use of electrical energy introduced heavy equipped and stepped tariff and separate accounting of energy consumption on a «day-night». Of course, separate accounting and tariff are significant economic impact in the area of production. It is therefore necessary to review and adjust the process conditions so as to reduce power consumption in the clock «peak» loads on the electrical network and maximum load power-intensive processes in the hours of night loads of dips. The use of all these measures will reduce the energy intensity of production, provision of service, will significantly reduce costs for domestic consumption of electricity and heat [7, 8].

The international economy has a smooth transition to energy-saving lifestyle. We have not taken serious steps to save energy, heat, water, etc. solar panels will be used in the future, energy-saving light bulbs, cars on hydrogen fuel, electric. Rational energy efficiency will lead to a serious reduction in the energy intensity of the economy and, therefore, its progress and sustainability.

The government puts the most important task of rational use of natural, energy resources, provide the population with cheap and affordable type of fuel. So intensively produced gasification of settlements in Atyrau region, allowing to improve the conditions of work and life of the population, as well as to reduce environmental pollution.

In order to ensure stable economic growth, it is necessary to reach the advanced development of the electricity industry, having a huge potential of renewable energy sources (about 1 bln. KW·h per year), whose share in electricity production currently stands at 0.5 %. In the future, it is necessary to increase this figure to more than 1 %, corresponding to about 1 billion kW·h per year. The government has set priority tasks to achieve sustainable and balanced economic growth is inextricably linked with the performance of one of the main tasks of socio-economic development of the Republic of Kazakhstan - to stimulate the transition to energy-saving technologies.

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### Атырау облысы энергетикасының заманауи жағдайы

Мақала Атырау облысының энергетикасының заманауи жағдайын және аймақты энергиямен тиімді қамтамасыз етуге, аймақтың энергетика саласына технологиялық инновацияларды енгізу жоспарында құндылық болып табылатын тұрмыс пен өндірістегі энергияның баламалы көздерін зерттеуге арналған. Қазіргі уақытта және алдағы болашақта барынша маңызды энергия қоры ретінде көмірсутек болып қала береді, себебі мұнай мен газ отын, минералдық және синтетикалық материалдарды өндіруде басты шикізат болып табылады. Осы қасиеттерінің арқасында олар тұрақты болады және әлемдік энергетикалық баланста ұзақ уақыт бойы бірінші болып қалады. Көптеген сараптамалық бағалау бойынша, жақын арада көмірсутек шикізатының үлесі 80 %-дан төмен түспейді және бұл ресурсқа деген жоғары сұраныс халықаралық қатынастардың барынша көбірек трансформациясының мұнай мен газ кен орындары аймақтарын және оларды тасымалдау жолдарын бақылауға аумақтық тартылу геосаясаттан тәуелді. Бүгінде электрэнергетикалық кешен жоғары капитал сымды және инерциялы кешен ретінде сипатталады. Сондықтан электрэнергетиканы дамыту бойынша ол аймақ пен елдің дамуын тежейтін экономикадағы «тар орын» болмайтындай және әлемдік экономикаға интеграциялану жағдайында бәсекеге қабілетті болатындай шаралар кешені қажет.

*Кілт сөздер:* энергетика, аймақты энергиямен қамтамасыз ету, электр энергиясын тасымалдау, көмірсутек шикізаты, энергетикалық және минералдық ресурстар, экономиканың негізгі салалары.

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### Современное состояние энергетики Атырауской области

Статья посвящена исследованию современного состояния энергетики Атырауской области и эффективному энергообеспечению региона, использованию в быту и производстве альтернативных источников энергии, что представляет ценность в плане внедрения технологических инноваций в энергетическую отрасль региона. Отмечено, что в настоящее время и в обозримой перспективе наи-

более значимыми энергоресурсами будут оставаться углеводороды, так как нефть и газ являются определяющим видом сырья для производства топлива, минеральных и синтетических материалов. Благодаря своим свойствам они будут стабильно и долгосрочно лидировать в мировом энергетическом балансе. Согласно большинству экспертных оценок доля углеводородного сырья в ближайшее время не опустится ниже 80 % и высокая потребность на этот ресурс обуславливает все большую трансформацию международных отношений — от геополитики, территориальных притязаний к контролю над зонами нефтегазовых месторождений и маршрутами их транспортировки. Подчеркнуто, что на сегодняшний день электроэнергетический комплекс характеризуется как высококапиталоемкий и инерционный, поэтому необходим комплекс мер по развитию электроэнергетики, чтобы она не оказалась «узким местом» в экономике, тормозящим развитие региона и страны в целом, и была конкурентоспособной в условиях интеграции в мировую экономику.

*Ключевые слова:* энергетика, энергообеспечение региона, транспортировка электроэнергетики, углеводородное сырье, энергетические и минеральные ресурсы, базовые отрасли экономики.

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