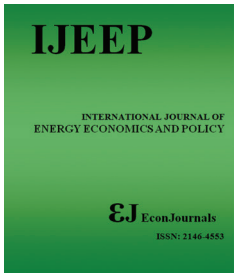

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Analysis of Prospects for Sustainable Land use (Lands of Agricultural Designation) in the Republic of Kazakhstan in the Context of the Development of Alternative Energy

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ABSTRACT

The main purpose of this paper is to identify the promising directions of arable areas use of the Republic of Kazakhstan. The authors present a methodology for calculating the integral index which is based on a system of quantitative indicators reflecting the use of agricultural land and efficiency of agricultural production. Using these methodologies, the authors conducted a comprehensive evaluation of sustainable land use in the regions of the Republic of Kazakhstan. The results of the study allow the authors to conclude that the arable areas are used inefficiently. An important reserve for increasing the efficiency of agriculture can become an alternative energy. The specific interest is the development of bio-energy as a promising tool for sustainable development of the agricultural sector.

Keywords: Land Resources, Sustainable Land Management, Alternative Energy, Inexhaustible Energy Sources, Bioenergy, Biological Fuel
JEL Classifications: R14, R52, Q10

1. INTRODUCTION

The agrarian orientation of the Republic of Kazakhstan requires improving the land resources as the main means of production. Land as a basis of ecosystem, instrument of labor, product and the item of property is the basis of sustainable development, the condition for social progress and human welfare. The introduction of the balanced land use is a much-needed challenge.

At the state level, the issue of increasing the value of land resources and their rational use has not been solved yet. It was established that the economic approach is the predominant in the land use; social and environmental ones have, respectively, the second and third places from the point of view of domestic and foreign scientists about the condition of land use. To change this situation, there is a need to develop innovative approaches to the identification and assessment of intensification of land use, to do a mandatory accounting and inventory of existing land and to determine the boundaries (Espolov and Seifullin, 2004).

The issues on improving the efficiency of land use and the scientific basis for the sustainable development in the Republic of Kazakhstan more often attract the attention of the scientific and expert community.

Atesheva and Aleknavichyus (2013) have conducted the analysis of the process of land reform in the country. They pointed out 5 stages in reform 59 and their specifics, and put forward the basic tools in the regulation of relations. Asetova et al. (2013) described the structure of agricultural enterprises and the causes for changes in cultivated areas. Gilmanova and Gurskene (2013) put forward proposals for the development of farms. The issues of rational use of land resources and their management with economic and environmental point of view were presented by Orazalinova (2016). The author gave the characteristics of land reserves, described the structure of arable areas of the country and has identified the main provisions in the use of land resources.

The principles of sustainable development have been declared at the Summit of the United Nations Conference on Environment

and Development in Rio de Janeiro (1992). This document was signed by Kazakhstan at the highest level formally recognizing it as the guidelines for action.

The ideology of sustainable development has a special place in the official ideology and propaganda of the Republic of Kazakhstan. So, at the 18th plenary session of the Foreign Investors Council under the President of the Republic of Kazakhstan 10 years ago, the President said that "sustainable development can and must be a Kazakhstan brand" (Iskakov, 2008).

The principles, goals, objectives and key mechanisms for achieving the sustainable development in various sectors of Kazakhstan's economy were laid in the Concept of Transition of Kazakhstan to Sustainable Development for the period of 2007-2024.

To improve the efficiency of agricultural production, the strategic program for the development of agro industrial complex of the republic called "Agribusiness-2020" was designed, the law "On State Regulation of the Development of Agriculture and Rural Areas" was adopted, as well as other separate regulations and governing mechanisms for their implementation.

Given the fact that the Government recognizes the importance of the agricultural sector for the national economy, the concept on the transition to a "green" economy was developed upon an initiative of the president. Within the framework of the concept, seven key areas of the transition to "green" economy were identified including the sustainable and productive agriculture, energy saving and energy efficiency; an increase in the proportion of renewable energy sources (RES), etc.

It should be noted that the stability of agriculture is directly dependent on the effective use of land resources and reduction of the resource intensity in agricultural production. An important reserve for increasing the efficiency of agriculture is the development of bio-energy and the transition to alternative energy sources.

The applicability of bioenergy is in need for the number of challenges: High energy intensity and energy dependence of agricultural production, low level of domestic production of protein for animal feed; inefficient use of agricultural land. Using agricultural raw materials for power generation opens up new possibilities for the development of agriculture; it will allow to modernize the economic flows and to create a new regional capitalization.

2. METHODOLOGY

The main purpose of this study is to identify promising areas for sustainable land use in the context of the development of RES in the Republic of Kazakhstan. To achieve this goal, it is necessary to solve the following tasks:

- To investigate the dynamics and structure of the land fund of the Republic of Kazakhstan;
- To assess the effectiveness of agricultural land use and sustainable development of the agriculture of the Republic of Kazakhstan;
- To identify prospects for bioenergy development as one of the most important factors in ensuring the sustainability of agriculture and improvement the utilization of the land resources of Kazakhstan.

Research methods: Monographic, logical analysis method, historical and mathematical-statistical.

Data for study: Data from the state cadastral information registry, regulations. Statistical data and analysis on the Kazakh Statistics Committee, the Ministry of Agriculture, Ministry of Energy of the Republic of Kazakhstan and others.

In order to conduct a comprehensive assessment of sustainable land use, the method of calculating the integral index is proposed. It is based on a system of quantitative indicators in two blocks:

- Indicators of the use of agricultural land;
- Indicators of the efficiency of agricultural production.

To evaluate the efficiency of the use of agricultural land of Kazakhstan, a system of quantitative indicators is proposed in Table 1.

Indicators reflecting the efficiency of agricultural production are in Table 2.

Further, based on the index values, each region is assigned a numerical score which is calculated according to the formula:

The Integral point of sustainable land use is calculated as follows:

$$I_{sl} = 0.4\, I_{ag} + 0.6 I_{ef}$$

Where,

I_{ag} - integral point of the use of agricultural land is calculated as the arithmetic mean of the scores according to the first group of indicators.

I_{ef} - integral point of efficiency of agricultural production is calculated as the arithmetic mean of the scores according to the second group of indicators.

0.4 and 0.6 - the proportion of importance for groups of quantitative indicators.

3. ANALYSIS OF THE STRUCTURE OF AGRICULTURAL LANDS OF THE REPUBLIC OF KAZAKHSTAN

According to the data of the State System of Accounting of Land dated November 1, 2016, the total area of the land fund of the Republic of Kazakhstan is 261,173.8 thousand hectares, the arable areas of which are 214.838.5 thousand hectares or 82.2%.

Arable areas include fertile soils, forests. We can assume that the structure of these areas is heterogeneous, it include most of the land designed for growing and producing of high-quality crop.

Lands of agricultural designation are 100,835.4 thousand hectares which is 38.6% of the total land fund (Table 3).

Agricultural lands are subject to special protection aimed at preserving of their area, preventing the development of negative

processes and increasing soil fertility. Since 1991, the total area of agricultural land has decreased by 117,540.4 thousand hectares or by 53.8%.

The share of lands of agricultural designation in land resources of other regions ranges from 60% to 65% in the North Kazakhstan and Akmola regions up to 15-20% in Kyzylorda, Semipalatinsk region of the East Kazakhstan. This is due to the differences in climatic conditions and the presence of vast areas of desert rangelands in the central and southern regions of the country.

In recent years, the area of agricultural land has been increasing in all areas of the Republic of Kazakhstan, mainly due to the involvement of the reserve land. In 2015, the total agricultural land area has increased by 2255.2 thousand hectares. Most of the growth was in Kyzylorda region - by 0.9 million hectares and in Pavlodar region - by 0.6 million hectares.

The main part of farmland is for pastures (68.5%) providing almost a half of the total amount of feed in the country. The structure of the agricultural land of the Republic of Kazakhstan on the basis of 2015 is presented in Figure 1.

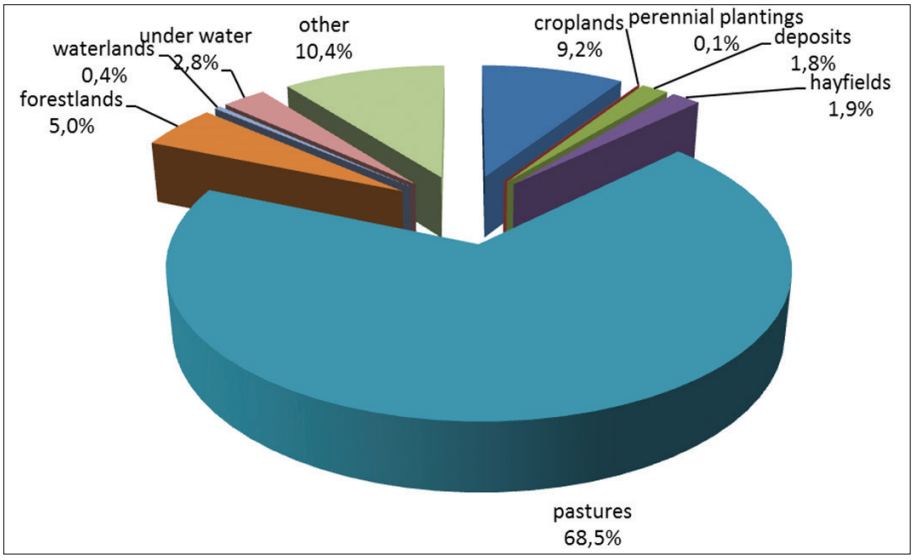
Table 1: The system of quantitative indicators of agricultural land use

Name of indicator	Formula	Full form
Arable land use index	$I_u=S_{pf}/S_{al}$	S_{pf} - specified cultivated area of crop, thousand hectares S_{al} - area size of arable land, thousand hectares
Plough-disturbance of tilled areas	$I_{pl}=S_{al}+S_{pp}/S_{ag}$	S_{al} - area size of arable land, thousand hectares S_{ag} - the total area of farmland
Farmland quality index	$I_q=S_{agp}/S_{ag}$	S_{agp} - agricultural area without negative signs S_{ag} - the total area of farmland
Disturbed lands index	$I_{dl}=S_{dl}/S_{ag}$	S_{dl} - area size of the disturbed land, hectares S_{ag} - the total area of agricultural land, thousand hectares
Depleted land index	$I_{wl}=S_{wl}/S_{dl}$	S_{wl} - area size of the depleted land, hectares S_{dl} - area size of the disturbed land, hectares
Irrigated land index	$I_{il}=S_{il}/S_{ag}$	S_{il} - area size of the irrigated area, hectares S_{ag} - the total area of agricultural land, thousand hectares

Table 2: Quantitative indicators reflecting the efficiency of agricultural production

Name of indicator	Formula	Full form
Index of gross agricultural production	$I_{gpa}=S_{gao}/S_{ag}$	S_{gao} - gross output (services) of agriculture, million tenge S_{ag} - the total area of farmland
Crop yield of grain and leguminous	Statistical indicators of the Statistics Committee of the Kazakhstan Republic	Agriculture, Forestry and Fisheries in the Republic of Kazakhstan 2011-2015 Statistical bulletin (Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan, 2015)
The level of profitability (loss) of agricultural production		
The level of profitability (loss) of crop production		
Prime cost of 1 quintal of sales of crop in the agricultural enterprises		

Figure 1: The structure of the agricultural land of the Republic of Kazakhstan in 2015



The total area of agricultural land for grazing is 186,526.6 thousand hectares, 68,362.5 thousand hectares of which belong to the category of lands of agricultural designation, 20,850.4 thousand hectares belong to the settlement lands and 78,524.1 thousand hectares - to reserve lands. During the period of 1991-2015, the total area of pastures in the Republic of Kazakhstan has increased by 5,116.1 thousand hectares.

At year-end 2015, the area size of arable land is 24,934.7 thousand hectares in the Republic of Kazakhstan which is 9.2% of the total area of farmland. Arable land is called farmland used for growing crops, or intended to do so. More than 97.4% of the area size of arable land is part of lands of agricultural designation. During the period of 2011-2015, the area size of arable land is decreased by more than 30% (Table 4) in the Republic of Kazakhstan.

The main areas of arable land as part of the agricultural land is concentrated in Akmola (23.1%), Kostanai (24.8%) and North Kazakhstan (19.8%) regions.

4. EVALUATION OF THE EFFECTIVENESS OF THE USE OF AGRICULTURAL LAND IN THE REPUBLIC OF KAZAKHSTAN

The initial data for assessing the effectiveness of the use of agricultural land in the Republic of Kazakhstan are presented in Table 5.

The calculation of the indices in the groups of indicators about the use of agricultural areas of the Republic of Kazakhstan is presented in Table 6.

As a result of scoring of group of indicators about the use of agricultural land, the integral index was identified for each region of Kazakhstan which is shown in Figure 2.

The Figure 2 shows that the southern regions of Kazakhstan, Almaty (0.617) region, and South Kazakhstan (0.672) have the most effective use of agricultural land. The East Kazakhstan (0.451), Karaganda (0.454) and Mangistau (0.465) regions have the least importance.

Table 7 shows the statistical data reflecting the efficiency of agricultural production in the regions of the Republic of Kazakhstan.

The score of the effectiveness of the agricultural production of cereals in the regions of the Republic of Kazakhstan is presented in Table 8.

As the analytical data say, the North Kazakhstan, South Kazakhstan and Almaty regions have the first place according to the index of gross output of agriculture. At the same time, the Kostanai and Akmola region are the leaders in the level of profitability of agricultural production. The most efficient agricultural production is carried out in the Akmola, Kostanay and North Caucasus regions.

In general, it should be noted that there is a significant potential for the development of agriculture in the regions of Kazakhstan by means of currently unused agricultural land, as well as searching for new technologies for processing agricultural waste in order to improve profitability and increase value-added agricultural production.

Table 3: The structure of the land fund of the Republic of Kazakhstan

Name of categories of land	1991	2014	2015	Changes (+, -)	
				2015 1991	2015 2014
Lands of agricultural designation	218,375.8	98,580.2	100,835.4	−117,540.4	+2,255.2
Settlement lands	3,747.2	23,804.8	23,751.5	+20,004.5	−53.3
Including:					
Cities and towns	2,053.5	2,254.9	2,265.7	+212.2	+10.8
Rural settlements	1,693.7	21,479.9	21,485.8	+19,792.1	−64.1
Land of industry, transport, communications, for the needs of space activities, defense, national security and of other nonagricultural designation	18,796.8	2,778.8	2,826.0	−15,970.8	+47.3
Specially protected natural sites, lands used for nature protection, recreational and historical and cultural purposes	775.1	6,634.3	6,613.4	+5,838.3	−20.9
Forestry fund lands	10,179.2	22,850.6	22,899.6	+12,720.4	+49.0
Water fund lands	819.9	4,120.9	4,124.2	+3,304.3	+3.3
Reserve lands	18,952.3	102,404.3	100,123.7	+81,171.4	−2,280.6
Total	271,646.3	261,173.8	261,173.8	−10,472.5	-
Including land used in the territory of other states	149.8	0.9	0.9	−148.9	-
Land used by other states	993.7	11,317.3	11,317.3	+10,323.6	-
The Territory of the Republic	272,490.2	272,490.2	272,490.2	-	-

Table 4: Dynamics of agricultural land

Indicator	1991	2001	2015	Change	
				±	%
Farmland, thousand hectares	222,368.3	222,485	214,838.5	−7,529.8	−3.39
Including arable land, thousand hectares	35,384	21,399.9	24,632.90	−10,751.1	−30.38
Hayfields, thousand hectares	5,121.1	5,015.5	5,189.90	68.8	1.34
Pastures, thousand hectares	181,410.5	187,081.8	187,690.70	6,280.2	3.46
Perennial plantings, thousand hectares	186.1	166.3	151.2	-34.9	-18.75

Table 5: Quantitative indicators of the use of agricultural land in the Republic of Kazakhstan (according to the data for 2015)

The regions and cities of the Republic of Kazakhstan	Area size of arable land, thousand hectares	Specified cultivated area of crop, thousand hectares	The total area of agricultural land, thousand hectares	Area size of agricultural land without negative signs, thousand hectares	Area size of the disturbed land, hectare	Area size of the depleted land, hectare	Area size of the irrigated area, thousand hectares	Area size of agricultural land with permanent crops, thousand hectares
Akmola region	5,615.6	4,687.5	13,187.9	4,995.5	17,484	7288	31	5.2
Aktobe region	538.4	501.4	26,225.2	7,872.9	15,454	3018	28.1	1
Almaty region	1,037.7	926.2	15,848	2,958.6	6,802	800	577.8	20.4
Atyrau region	4.9	6.8	9,114	537.9	2,097	51	16.2	0.5
West Kazakhstan region	537.9	488.2	12,777.3	1,528.2	3,652	392	55.8	1.7
Zhambyl region	761	587.7	9,347.8	669.7	6,605	1982	229.7	3.3
Karaganda region	1,100.8	994.7	33,007.2	3,654.3	44,819	10,639	87.9	1.9
Kostanay region	6,022.3	5,088.0	18,129.3	5,898.1	37,756	13,978	32.4	0.5
Kyzylorda region	156.6	167.8	12,156.8	1,127.2	2,448	711	238.6	9.4
Mangystau region	0.4	1.6	12,655.9	1,600.9	78,574	3593	2.1	0.2
South Kazakhstan region	875.4	775.8	10,129.4	1,629.7	12,146	1232	561.1	27.2
Pavlodar region	1,392.7	1,145.0	11,167.6	1,606.5	2,690	94	63.8	1.7
North Kazakhstan region	4,815.9	4,372.4	8,404.3	4,180.2	6,661	4515	15.5	2.7
East Kazakhstan region	1,429.5	1,278.0	22,645.2	3,230.1	12,784	5134	200.7	2.3
Astana	1.8	1.4	12.2	3	227	-	0.3	1
Almaty	1.9	0.4	30.4	25.6	-	-	1.2	6
Total	24,292.8	21,022.9	214,838.5	41,518.4	250,199	53,427	2,142.2	85

Table 6: Indices of the group of indicators about the use of agricultural areas in the regions of the Republic of Kazakhstan

Regions of the Republic of Kazakhstan	Arable land use index I_u (%)	Plough-disturbance of tilled areas I_{pl} (%)	Farmland quality index I_q (%)	Disturbed lands index I_{dl} (%)	Depleted land index I_{wl} (%)	Irrigated land index I_{il} (%)
Akmola region	83.5	42.62	37.88	0.13	41.68	0.24
Aktobe region	93.1	2.06	30.02	0.06	19.53	0.11
Almaty region	89.3	6.68	18.67	0.04	11.76	3.65
Atyrau region	100.0	0.06	5.90	0.02	2.43	0.18
West Kazakhstan region	90.8	4.22	11.96	0.03	10.73	0.44
Zhambyl region	77.2	8.18	7.16	0.07	30.01	2.46
Karaganda region	90.4	3.34	11.07	0.14	23.74	0,27
Kostanay region	84.5	33.22	32.53	0.21	37.02	0.18
Kyzylorda region	100.0	1.37	9.27	0.02	29.04	1.96
Mangystau region	100.0	0.00	12.65	0.62	4.57	0.02
South Kazakhstan region	88.6	8.91	16.09	0.12	10.14	5.54
Pavlodar region	82.2	12.49	14.39	0.02	3.49	0.57
North Kazakhstan region	90.8	57.33	49.74	0.08	67.78	0.18
East Kazakhstan region	89.4	6.32	14.26	0.06	40.16	0.89
Astana	77.8	22.95	24.59	1.86	n/a	2.46
Almaty	21.1	25.99	84.21	n/a	n/a	3.95
Total	86.5	11.35	19.33	0.12	21.35	1.00

5. THE DEVELOPMENT OF ALTERNATIVE ENERGY AS A RESERVE FOR INCREASING THE EFFICIENCY OF AGRICULTURE IN THE REPUBLIC OF KAZAKHSTAN

A significant reserve for increasing the efficiency of agriculture is the alternative energy. The basis of the economy of Kazakhstan mostly is the extraction of natural resources; this is due to the relative resource endowment. The country has huge energy reserves: Oil, gas, coal and uranium.

However, the regional energy market in Kazakhstan is characterized by a relatively low efficiency. The main problems include aging of infrastructure, high energy consumption and low energy efficiency, the unused potential of alternative energy.

The Official Energy Strategy of Kazakhstan sets ambitious targets for a significant shift in electricity production towards RES in the long term. In May 2013, the government adopted the concept of "green" economy and set an ambitious target to have 50% of alternative and RES in the energy balance by 2050 (Concept of Transition of the Republic of Kazakhstan to the "Green Economy," 2013).

Figure 2: The chart of the indicator of agricultural land use in the regions of the Republic of Kazakhstan (based on 2015)

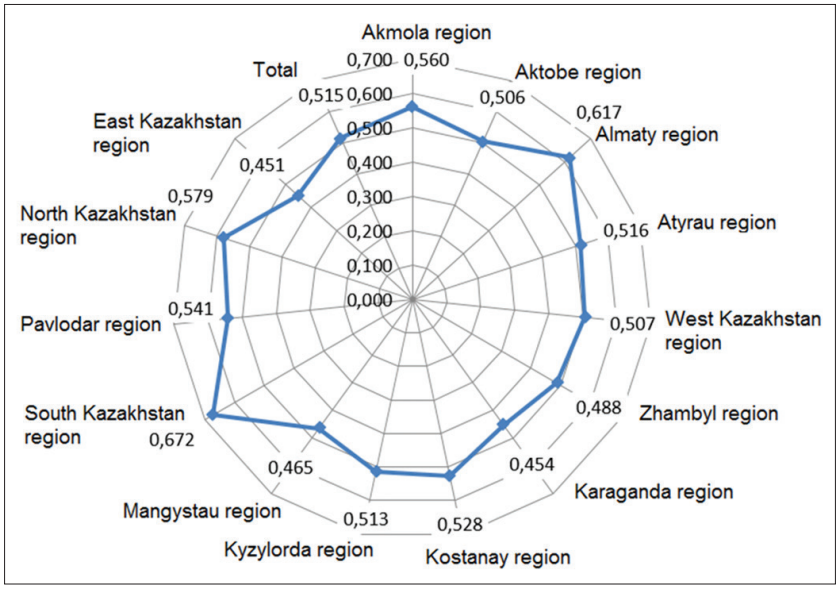


Table 7: The data reflecting the efficiency of agricultural production in the regions of the Republic of Kazakhstan

Regions of the Republic of Kazakhstan	Gross output (services) of agriculture, million tenge	The total area of farmland	Crop yield of grain and leguminous	The level of profitability (loss) of agricultural production, %	The level of profitability (loss) of crop production, %	Prime cost of 1 quintal of grain, tenge
Akmola region	290,893.2	13,187.9	11.6	42.8	48	2292
Aktobe region	165,244.3	26,225.2	11.9	9.6	34.8	2949
Almaty region	551,101.1	15,848	27.9	11.8	26.6	2305
Atyrau region	58,765.5	9,114	47.0	13.3	11.8	0
West Kazakhstan region	106,544.4	12,777.3	14.5	15.6	28.5	5769
Zhambyl region	218,726.5	9,347.8	24.6	16.8	26	2384
Karaganda region	197,273.0	33,007.2	12.3	16.9	45.1	2150
Kostanay region	294,608.2	18,129.3	10.8	44.1	54.6	1985
Kyzylorda region	79,186.5	12,156.8	46.6	22.3	23.1	4036
Mangystau region	11,734.3	12,655.9	0.0	−0.9	−21.7	0
South Kazakhstan region	426,894.4	10,129.4	24.3	18.8	16.9	2695
Pavlodar region	152,407.9	11,167.6	10.3	30	51.1	2550
North Kazakhstan region	380,814.2	8,404.3	15.7	24.3	25.9	2021
East Kazakhstan region	366,973.1	22,645.2	13.7	20.8	33.9	3003

Table 8: The score of effectiveness of agricultural production of the regions of the Republic of Kazakhstan

Regions of the Republic of Kazakhstan	Score on the index of gross agricultural output	Crop yield of grain and leguminous	The level of profitability (loss) of agricultural production, %	The level of profitability (loss) of crop production, %	Prime cost of 1 quintal of grain, tenge	Integral point of efficiency of agricultural production
Akmola region	0.48	0.25	0.95	0.91	0.60	0.64
Aktobe region	0.12	0.25	0.21	0.74	0.49	0.36
Almaty region	0.76	0.59	0.26	0.63	0.60	0.57
Atyrau region	0.12	1.00	0.30	0.44	1.00	0.57
West Kazakhstan region	0.17	0.31	0.35	0.66	0.00	0.30
Zhambyl region	0.51	0.52	0.37	0.63	0.59	0.52
Karaganda region	0.11	0.26	0.38	0.88	0.63	0.45
Kostanay region	0.35	0.23	0.98	1.00	0.66	0.64
Kyzylorda region	0.13	0.99	0.50	0.59	0.30	0.50
South Kazakhstan region	0.93	0.52	0.42	0.51	0.53	0.58
Pavlodar region	0.29	0.22	0.67	0.95	0.56	0.54
North Kazakhstan region	1.00	0.33	0.54	0.62	0.65	0.63
East Kazakhstan region	0.34	0.29	0.46	0.73	0.48	0.46

The plan of measures for the development of alternative and renewable energy for the period of 2013-2020 was adopted in January 2013. According to the plan, it is expected to realize 31 renewable energy projects with capacity of 1.040 MW.

According to the results of 2015, the total capacity of RES in the Republic of Kazakhstan amounted to 2.795 MW. At that, RES capacity in hydropower engineering accounts for 2.682 MW (96% of total capacity of renewable energy), wind power - 56 MW and solar power - 57 MW (International Energy Agency, 2016).

The renewable capacity is estimated at more than 1,000 kWh per year including the wind potential of 1.300 kWh (not all is technically viable); the potential of biomass is 35 billion kilowatt-hours of electricity and 44 gigacalories (Gcal) of heat; the solar energy potential is 30 Kt of reference fuel, and the hydro potential is 170 kWh (62 TWh is technically feasible) (International Energy Agency, 2015).

Despite the considerable potential of RES, their contribution to the overall volume of power generation in Kazakhstan is still low. The share of renewable energy in total electricity production is only 0.77% (The Committee on Statistics of the Republic of Kazakhstan, 2016). The volume of electricity generated by RES in Kazakhstan in 2015 amounted to 0.704 billion KWh (with planned 0.7 billion KWh) (The Draft of the National Report on the State of the Environment and Natural Resources Management for 2015, 2015).

At the same time, in the sphere of energy production from RES the Republic of Kazakhstan gives place not only to the developed countries but also the neighboring ones in Central Asia (Figure 3).

During the period of 2006-2014, the total volume of energy from renewable sources in the Republic of Kazakhstan has increased from 7.700 to 8.277 Gigavatt-hour (Renewable Energy Agency, 2016). The average annual growth of renewable energy was 1.3% which is lagging behind the pace of growth in the Asian region (10.3%) and the global rate (5.6%).

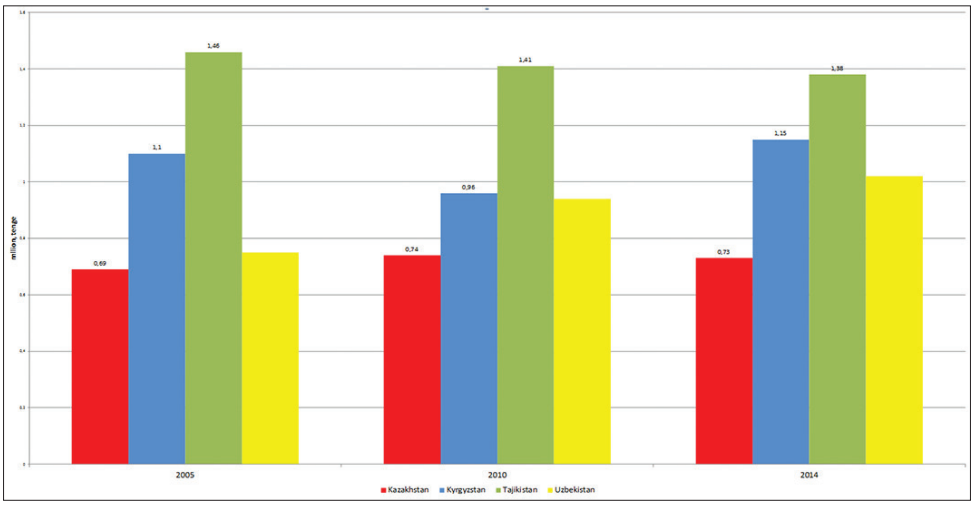
In recent years, the Republic of Kazakhstan has achieved some success in the field of wind and solar energy; the RES such as bioenergy is practically not developed. At the same time, bioenergy today is the world's largest RES; it provides about 10% of global primary energy supply. Bioenergy has a wide range of applications including power generation, industry of technological needs, space heating and cooking in houses, as well as liquid biofuels for transport.

6. THE PROSPECTS FOR THE USE OF AGRICULTURAL RAW MATERIALS IN THE PRODUCTION OF BIOFUEL

Along with the other RES in the Republic of Kazakhstan, biofuel has a significant potential, in particular, waste wood industry, vegetable waste from agriculture, crop waste, animal husbandry and poultry farming. Kazakhstan has a significant potential of biomass for biofuel production:

- Highly developed agricultural sector which annually generates a large amount of various wastes and residues. During the period of 2006-2015, the annual volume of waste in the agricultural sector, fisheries and forestry increased from 23.9 thousand tons to 1110.8 thousand tons, i.e., by 46 times. An important raw material for the production of biological energy production can be waste products of cereals and other crops. Kazakhstan is a major grain power: The average annual rate of bulk yield of grain (including rice and legumes) amounts to about 18,700 thousand tons for the last 5 years with the yield of 11-12 dt/ha. According to the results of 2015, this rate has reached 18,672.8 thousand tons; the specified cultivated area is 14,982.2 thousand hectares. The part of plant waste is used for the needs of agriculture (fertilizers, animal fodder and bedding); the other part is used by other sectors of the economy, and the remaining biomass is utilized.
- About 243.2 thousand hectares of arable land is not used; more than 78,524.1 thousand hectares of meadows and pastures are the reserve for the production of biomass for feed, food and bioenergy.
- Area size of land covered by forest is 12.7 million hectares, the territory of which covered with saxaul is 6,185.7 thousand hectares. The total stock of standing timber is estimated at

Figure 3: Energy production from renewable energy sources, million tenge (International Energy Agency, n.d.)



436.1 million cubic meters. During the period of 2011-2015, the volume of harvesting of the unprocessed timber has increased by 19% over the past 5 years and amounted to more than 328.2 thousand cubic meters.

- The significant amount of livestock and poultry provides the development potential of biogas production. According to the results of 2015, the number of cattle is 6,183.9 thousand cattle, 18,015.5 thousand sheep, 2,070.3 thousand horses, etc.

Special studies conducted by various international organizations such as the FAO, the International Agency for Renewable Energy (IRENA), and the IEA show that the implementation of bioenergy projects can improve the food security and contribute to the growth of the rural economy. At the same time, during the development of biofuel growth strategy, we should take into account the specific features of a given region, and to investigate the potential risks and threats.

The IEA notes that some of today's types of biofuels do not always meet the expectations of the criteria for the greenhouse gas emissions that contribute to deforestation and increase the pressure on agricultural land, necessary for the production of food and feed. The IEA urges governments that their policies of the support of RES help to shift to sustainable development of bioenergy resources including the use of advanced biofuels technologies.

Specialists in the IRENA note that there is significant potential for effective agricultural development based on the sustainable development of bioenergy including:

- Increasing yields of food crops and agricultural waste;
- Leaving the existing agricultural land for biofuel crops due to the further increase of productivity of agricultural lands;
- Reducing losses and waste in the food chain for the release of additional farmland for biofuel crops;
- Improving livestock management to leave pastures for biofuel crops.

State policies to promote the sustainable development of agriculture and the use of bioenergy and biofuels in particular include:

- Better understanding of the logistics cost for removal of agricultural and forestry waste;
- The collection of data about land resources that can be used for the sustainable development of biofuel crops including achievable yields;
- Conducting the in-depth research on cultivating fast-growing trees and grasses in the pastures which could sequester carbon and improve the biodiversity of the territory;
- Accelerating forest cultivation by creating incentives to grow trees on degraded lands, and through the exchange of best practices on sustainable forest management;
- Land tenure strengthening and land management improving in order to stimulate more intensive land use.

7. CONCLUSION

The Republic of Kazakhstan has a considerable potential with significant land resources for the effective development of the agricultural sector. The methodical approach allowed the authors to carry out a comprehensive assessment of the efficiency of the use of agricultural land in the Republic of Kazakhstan. As a result of the study, we can conclude the following:

- Agricultural lands which are the main means of production in the agriculture of the Republic of Kazakhstan are used inefficiently. At the same time, the regions of Kazakhstan have a significant potential to improve the profitability of agricultural production due to the involvement of the unused agricultural land and increasing production of biofuel crops.
- An important reserve for increasing the efficiency of agriculture can become alternative energy. Despite the considerable potential of RES, their contribution to the overall volume of power generation in Kazakhstan is still low.
- The significant potential for bioenergy development is in increasing yields of food crops and residues; releasing of land through higher yields; reducing losses and waste in the food chain; clearing of pastures through better livestock management.

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