

**WIDESPREAD USE OF MODERN TECHNOLOGIES AND INNOVATIONS IN  
AGRICULTURE**

<https://doi.org/10.5281/zenodo.11069454>

**Djumanazarova Altingul Tengelovna**

*Karakalpak Institute of Agriculture and Agrotechnology, Associate Professor of the  
Department of Irrigation and Land Reclamation, Candidate of Technical Sciences,  
Uzbekistan.*

The purpose of the study: is to analyze the possibility of reducing energy costs in the agricultural sector by applying the experience of introducing alternative types of energy in the conditions of the Republic of Karakalpakstan. In the Republic of Karakalpakstan, farmers have begun to study and analyze various ways to improve the energy efficiency of the agricultural sector: nutrient management, which includes planting local vegetation species; timing of fertilization; liming; application of manure immediately after fertilization; use of compost or liquid suspension obtained, for example, as a result of anaerobic digestion of manure – all this reduces processing soil is a well-known and effective measure to reduce energy consumption in arable systems.

The corresponding positive results usually include lower costs for the farmer and lower greenhouse gas emissions. Possible resource substitution options include: changes in irrigation; transition from traditional tillage to reduced or zero tillage; reduction in fertilizer application rates; improvement of nutrient management methods that reduce nutrient losses; reduction in plant protection intensity and mechanization level; early decommissioning of inefficient machines; transition to crops using less fertilizers and other energy resources; cultivation of grass as part of crop rotation or as cover and intermediate crops; production of biogas on farms from plant residues and manure; alternatives to livestock management related to feeding, housing and manure treatment.

In order to increase soil fertility and preserve it, it is necessary to introduce advanced technologies for cultivating land and harvesting in accordance with the zonal characteristics of the republic. It is revealed that the main tools for the development of sustainable agriculture are both political and agrarian reforms, income diversification, land conservation and more rational use of resources.

**Keywords:** *sustainable agriculture, economy, natural and climatic conditions, organic farming, mechanized process, alternative energy sources.*

**INTRODUCTION**

Energy is the most important component of agricultural production, with which equipment works, irrigates crops, fertilizes the soil, supports livestock, transports food and processes it. As the population continues to increase, an increase in agricultural production

is required to maintain the growing demand for food. At the same time, energy and environmental constraints require that agricultural production be carried out efficiently with minimal energy consumption. It is necessary to increase crop yields per unit area of land, while maintaining the integrity of the soil and the environment. Effective energy management techniques will help achieve and maintain this delicate balance. Almost all activity in the food system depends on some form of energy, which is currently mainly provided by fossil fuels.

The need to make effective use of scarce natural resources, reduce greenhouse gas emissions, minimize energy costs and increase the competitiveness of the agri-food sector highlights the importance of energy efficiency: using less energy to ensure the same level of production and services.

Improving energy efficiency in the agri-food chain is a priority in the Republic of Karakalpakstan, a key element of the green growth strategy. Food production systems vary significantly in their energy consumption and energy efficiency potential, mainly depending on the specific activity combined with agroecological conditions. This means that the possibilities for saving energy are numerous, but at this stage, identifying opportunities requires further research.

The growing dependence on energy consumption (mainly fossil fuels) throughout the food chain raises concerns about the impact of high or variable energy prices, on production costs, competitiveness, the final price of food for the consumer, as well as energy security. In addition to these problems, energy use in the food chain can also have environmental impacts, such as greenhouse gas emissions. Despite the progress made, the private and public sectors can do more to ensure that the energy efficiency potential of the food system is fully realized. Agriculture is one of the key sectors of the global economy.

As countries develop, it encourages the creation of regional manufacturing and service sectors. The existence of many industries depends on agricultural activities. With the technological development of agriculture, this sector will be transformed into an autonomous economic entity. He will be able to control the timing of the purchase of goods and services. It is likely that some production processes will be transferred to agricultural facilities as on-site quality control solutions are being developed.

The agricultural sector is one of the most important sectors of the economy of the Republic of Karakalpakstan and one of the few in which there is a constant increase in economic indicators. At the same time, there are a number of problems in the agricultural sector that need to be addressed both at the highest state level and at the level of small farms. From this point of view, certain natural prerequisites are necessary for the full development of agriculture. Climatic conditions vary depending on the region. The yield and type of crops grown depend on the amount of precipitation and sunny days.

Increasing the share of energy generated from alternative and renewable sources in the country's energy balance, ensuring the supply of uninterrupted electricity to consumers, reducing technical and technological losses through the creation of generation

sources in territories close to consumers and effective management of available resources are among the priorities of reforms carried out in the electric power sector. The use of energy saving and electrification opportunities can increase productivity, provide savings and reduce environmental impacts in farms of all types. Below are energy efficiency options that have been proven to save energy and money. Almost all activity in the food system depends on some form of energy, which is currently mainly provided by fossil fuels.

The need to make effective use of scarce natural resources, reduce greenhouse gas emissions, minimize energy costs and increase the competitiveness of the agri-food sector highlights the importance of energy efficiency: using less energy to ensure the same level of production and services. Accelerating climate change and growing resource scarcity are putting unprecedented pressure on the global community and have potentially serious consequences for the future well-being of people and the stability of key ecosystems. The variety of climatic conditions of the Republic of Karakalpakstan allows you to grow almost the entire range of crops and animals.

The main requirement in order to consider agriculture sustainable: it must meet the needs of present and future generations, ensuring both profit generation and maintenance of environmental health and socio-economic equality. Thus, against the background of limited land and water resources, it is necessary to ensure a significant increase in global food supplies. And this requires the increased use of intensive methods and new technologies that enable sustainable agricultural production. Therefore, the widespread use of modern technologies and innovations in agriculture currently acts as the main means of enhancing global food security and reducing the negative impact on the environment.

In addition, the sustainable use of land, the adaptation of agriculture to global climate change, and the growth of food production also make it necessary to continuously implement reforms in this area. Due to the large-scale agrarian reforms carried out in the Republic of Karakalpakstan, the growth rate in agriculture is stable. Sustainable food production and agriculture contribute to the improvement of the four main components of food security – availability, accessibility, use and stability – in all three dimensions of sustainability: environmental, social and economic.

The purpose of the study: is to analyze the possibility of reducing energy costs in the agricultural sector by applying the experience of introducing alternative types of energy in the conditions of the Republic of Karakalpakstan.

The methodology and results of the study. In the Republic of Karakalpakstan, farmers have begun to study and analyze various ways to improve the energy efficiency of the agricultural sector: nutrient management, which includes planting local vegetation species; timing of fertilization; liming; application of manure immediately after fertilization; use of compost or liquid suspension obtained, for example, as a result of anaerobic digestion of manure – all this reduces processing soil is a well-known and effective measure to reduce

energy consumption in arable systems. The corresponding positive results usually include lower costs for the farmer and lower greenhouse gas emissions.

In rain-fed agricultural systems, the use of machinery mainly for tillage and harvesting is usually the second largest energy consumption. One way to reduce the energy consumption of machines is to use systems without tillage or reduced tillage. Fuel consumption during non-tillage is invariably less than when using conventional arable systems, although the degree of fuel use will strongly depend on the type of soil, the depth of plowing, as well as the number and type of secondary cultivation.

The absence of tillage can also have the advantage of reducing greenhouse gas emissions and improving soil water permeability. In some cases, no-till methods can reduce fuel consumption for cultivation by 60-70%, and total investment in machinery by 50%. They can also reduce soil carbon losses. These cost reductions usually lead to an immediate increase in profits when implementing a no-till system, even in cases where yields, for example, do not respond positively in the first few years. In addition, the practice of no tillage allows large farms to take advantage of technological advances such as guided road management and GPS-based precision farming, resulting in higher levels of energy and resource efficiency.

Therefore, solutions in the field of sustainable energy include the use of renewable energy produced by wind, solar, biofuels, biomass and waste, geothermal and small hydraulic installations, as well as technologies and approaches that reduce energy consumption per unit of output. In recent years, there has been a trend of development and transformation of agriculture. Energy needs vary greatly in farming systems, which can be used to reduce energy consumption and improve energy efficiency. These broadly include: technological progress, substitution of resources in agriculture and changes in demand for agricultural goods.

Technological progress can be achieved with respect to energy efficiency of all major types of resources. Key strategies may include: more efficient equipment; improved management of agrochemicals (e.g. precision farming with specific management of nutrients, pesticides and water on site); more efficient irrigation systems; genetic improvements to plants and livestock; improved insulation; efficient light sources and more efficient heaters. Bioenergetic and biomaterial strategies can also be used. For example, a large range of isolated energy crops, plant residues, livestock manure and by-products of agricultural processing can be converted into energy or industrial material cellulose into biofuels; the creation of improved crop varieties for the production of industrial oils and biopolymers helps to reduce consumption and dependence on fossil energy.

Energy savings on farms and energy efficiency improvements can also be achieved using existing technologies by replacing inputs. The replacement of input resources is due to economic conditions, primarily the cost of energy. If the relative price of energy increases, then the total energy intensity at a given level of production will fall. However,

the resulting substitution effects can be complex because energy is contained to varying degrees in almost all agricultural resources.

Changes in the demand for agricultural goods affect the total volume of production and, consequently, the total amount of energy used in the food system. Demand is determined by market prices, policies, and consumer preferences. These factors may contribute to a change in the human diet towards less energy-intensive products and an increase in demand for renewable energy sources and products. The most important factor on the demand side is changes in relative energy prices. Higher energy prices increase the wedge between environmentally friendly and energy-intensive goods and thereby shift consumption towards the former.

In the short term, possible resource substitution options include: changes in irrigation; transition from traditional tillage to reduced or zero tillage; reduction in fertilizer application rates; improvement of nutrient management methods that reduce nutrient losses; reduction in plant protection intensity and mechanization level; early decommissioning of inefficient machines; transition to crops using less fertilizers and other energy resources; growing grass as part of crop rotation or as cover and intermediate crops; production of biogas on farms from plant residues and manure; alternatives to livestock management related to feeding, housing and manure treatment. In the long term, farmers have more flexibility to reduce energy use by purchasing more energy efficient equipment and making other changes to their agricultural activities.

Most of the energy associated with fertilizers is consumed not directly on the farm, but indirectly, during its production, packaging and transportation to the site. Other energy inputs include animal feed, hybrid seeds, and water. However, reduced tillage has a number of disadvantages. Of these, the most important is the high use of herbicides, as they are often used to minimize the growth of weeds that would otherwise be controlled (at least in large-scale agriculture) by plowing and other more intensive tillage methods. The production of herbicides itself entails energy consumption. However, it is claimed that, on average, burning herbicides requires less energy than tillage. Secondly, depending on soil and climatic conditions, a reduction in tillage may also lead to a decrease in crop yields. In addition, in some cases, there was an increased dependence on mulching materials that compete with each other as livestock feed.

The energy balance is determined by which feeds are displaced. Another way to increase energy efficiency in agriculture is the use of precise technologies that calculate the optimal amount, timing and place of use of resources and thereby create savings related to both the use of fuel and fertilizers. Precision farming is a relatively new management practice made possible by the development of information technology and remote sensing. This is an approach to managing the entire farm in order to optimize the return on investment while improving the environmental impact of agriculture. However, different technologies have different potential, which must be considered specifically in terms of the impact on energy efficiency and environmental impact. Climate change, the

growing world population and related food needs are the challenges of agriculture in ensuring increased crop yields worldwide in increasingly difficult conditions with less availability of resources such as soil, water, nutrients, and reduced use of plant protection products.

Economic and environmental potential should be realized in appropriate regional conditions, taking into account the social aspect of sustainable development. Therefore, food production should be associated with the integration of technologies and farming methods.

One of the most important areas of the so-called "green" economy is sustainable agriculture, which in these modern conditions is becoming more and more "organic". In the modern world, agriculture does not fully meet the requirements of the global world, as this system of agricultural production is extremely wasteful. In this regard, a new trend in modern agriculture is becoming relevant – the development of organic agriculture and animal husbandry.

To solve the problem, it is necessary to: support educational initiatives; use economic innovations and develop new technologies, ensuring stable access to food that meets human needs; ensure access to them for poor groups; develop commodity production; reduce unemployment and raise income levels in order to combat poverty; manage natural resources and protect the environment". In this regard, the sustainable development of agriculture is an urgent issue not only for the country as a whole, but also for its individual regions.

Over the past decades, no branch of the economy has undergone such large-scale transformations as the agricultural one.

For the formation and development of sustainable agriculture, special loans are required for these projects in agriculture, which will be aimed at preserving natural biodiversity, along with growing monocultures on relatively large areas, maintaining natural landscapes – meadows, wastelands, swamps.

Animals, feed and fertilizers should be considered as a single equilibrium system. In the global context of sustainable development of the agricultural sector, the agro-industrial sector plays a leading role - the largest employer in the world, which is often involved in global land use. It endangers natural ecosystems, accounts for about a quarter of global greenhouse gas emissions; is crucial to global food security and is vulnerable to climate change. The agro-industrial sector and the food industry occupy a major place in the economy of the Republic of Karakalpakstan. That is why investments in agriculture have one of the best effects, contributing to economic growth, improving food security and fighting poverty.

The growth of agricultural production is significant, despite the sharp reduction in the number of farmers, especially in developed countries, production has increased significantly. The generally accepted imperatives of sustainable development are economic, social and environmental. The economic program implies the optimal use of

limited natural resources and the creation of a "green" economy. Social – aims to eliminate poverty, reduce the number of destructive conflicts and preserve social and cultural systems. From an ecological point of view, sustainable development should ensure the integrity and viability of biological and physical natural systems. It should be noted that the objective prerequisites for the formation of the concept of sustainable agricultural development are unresolved problems of a global nature. In particular, the problems of global warming, degradation of land resources, pollution of groundwater in rural areas, destruction of natural ecosystems, etc. are relevant.

Raising awareness about how and where energy is used is crucial when developing energy efficiency measures. To establish whether large-scale energy efficiency investments to reduce energy demand are more profitable than the cost of new energy supplies, it is important to have reliable information about the net benefits of energy savings. This includes the cost of the programs, the cost of energy saved, and any associated benefits. Until recently, manufacturers and consumers paid little attention to energy efficiency. For example, the priority of the food industry is the safety, quality and hygiene of the supplied product. Efficient use of energy is usually considered a priority only when energy prices are high, and not as a prerequisite.

Conclusion. From the above, it can be concluded that the creation of conditions that are conducive to the development of sustainable agriculture with the use of such alternative types of energy, as well as the use of energy-saving technologies, can lead to sustainable agricultural development, as well as the improvement of environmental policy. In order to increase soil fertility and preserve it, it is necessary to introduce advanced technologies for cultivating land and harvesting in accordance with the zonal characteristics of the republic.

To achieve these goals, it is necessary to: implement a program for the introduction of advanced technologies; information support for farmers and agricultural enterprises, drawing attention to the conservation and increase the potential of the most fertile agricultural lands in order to meet the needs of a growing population. It is necessary to preserve and restore natural resources on low-yielding lands in order to maintain anthropogenic pressure at a sustainable level. Based on this, from our point of view, the main tools for the development of sustainable agriculture in the Republic of Karakalpakstan are agrarian reforms, increasing soil fertility, land conservation and more rational use of water and land resources.

#### **LIST OF SOURCES USED:**

1. Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. UP-4947 "On the strategy of actions for the further development of the Republic of Uzbekistan" // [www.lex.uz](http://www.lex.uz) .

2. Decree of the President of the Republic of Uzbekistan dated 18.01.2017 "On the State Program for the development of the Aral Sea region for 2017-2021".

3. Джуманазарова А.Т.,Толепова Ш.Б.,Жуматова Р.М. Проблемы качества оросительных вод. «Science and innovation» INTERNATIONAL SCIENTIFIC JOURNAL (UIF: 8.2) (ISSN: 2181-3337) 2022 г. №3. <https://doi.org/10.5281/zenodo.6782763>

4. Джуманазаова А. Т., Генжемуратов А.С., Жуматова Р.М. Засоление почв в низовьях Амударьи- основная проблема орошаемого земледелия. Eurasian journal of academic research. 6 Part 3/, С- 163–168. <https://in-academy.uz/index.php/ejar/article/view/18387>

DOI: <https://doi.org/10.5281/zenodo.8103423>

5. Джаксымуратов К., Джуманазарова А., Курбаниязова Б. Изменение режима и использования пресных подземных вод в Южном Приаралье. Solid State Technology Том: 63 Выпуск: 6 Год публикации: 2020. Страницы: 15884-5887; <http://solidstatetechnology.us/index.php/JSST/article/view/7188>

6. Джуманазарова А.Т., Генжемуратов А., Джумамуратов Д. Изменение режима и использования пресных подземных вод в Южном Приаралье. Селекция, семеноводство, технология, выращивание и переработка сельскохозяйственных культур / Материалы Международной научно-практической конференции 26-27.08. 2021 Краснодар, 2021, стр. 249-253 DOI:10.33775/conf-2021-249-25.