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Investigation and Analysis of Energy Consumption in Agriculture and Animal Husbandry in Some Areas of Xizang

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Abstract: This study takes the agricultural and pastoral industries in Nyingchi, Lhasa, and Xigaze in the Xizang Autonomous Region as the research subjects. Through field research, questionnaire surveys, and data analysis, it systematically reviews the current energy consumption status of these industries in the three regions since 2025. The study finds that the energy structure of the agricultural and pastoral industries in the three regions is still dominated by traditional biomass energy and fossil energy, with a low proportion of clean energy; energy utilization efficiency is generally low, and there are issues such as outdated equipment and backward technology; power supply stability is insufficient, especially in remote pastoral areas; and energy costs account for an excessively high proportion of production costs, affecting the income levels of farmers and herdsmen. In response to the problems identified in the research, this article proposes optimization suggestions from four aspects: policy support, technology promotion, infrastructure construction, and talent cultivation. Firstly, increase the support for clean energy policies and implement special promotion plans for solar and wind energy; Secondly, promote efficient energy-saving equipment and establish an energy-saving technology service system for agriculture and animal husbandry; The third is to improve the infrastructure of the power grid and enhance the reliability of power supply in remote areas; The fourth is to strengthen energy technology training and enhance the energy-saving awareness of farmers and herdsmen. The research results can provide decision-making reference for the transformation of energy utilization and sustainable development of Xizang's agriculture and animal husbandry industry.

Keywords: Xizang agriculture and animal husbandry; Energy structure; Energy efficiency; Clean energy; Energy optimization.

1. Introduction

As an important ecological barrier and characteristic agricultural product base in China, agriculture and animal husbandry in the Xizang Autonomous Region play an important role in regional economic and social development. However, restricted by high altitude, complex terrain and extreme climatic conditions, the development of agriculture and animal husbandry in Xizang also faces many challenges such as insufficient energy supply and low energy utilization efficiency. In 2025, the project research team will conduct in-depth research on the energy use of agriculture and animal husbandry in Linzhi, Lhasa and Shigatse, three representative regions, with a view to providing decision-making reference for the transformation and sustainable development of energy use in Xizang's agriculture and animal husbandry.

2. Research Background and Significance

Xizang is rich in renewable energy such as solar energy and wind energy, but the degree of development and utilization is low. Agricultural and animal husbandry production still heavily relies on traditional biomass and fossil fuels, which not only have low efficiency but also cause ecological pressure. According to statistics, the energy self-sufficiency rate in Xizang's agricultural and pastoral areas is less than 40%, and the energy cost accounts for 25% -35% of the production cost of agriculture and animal husbandry, far higher than the national average [1, 2].

This study focuses on three typical regions: Linzhi (plateau humid climate), Lhasa (plateau temperate semi-arid climate), and Shigatse (plateau temperate arid climate), covering the main agricultural and animal husbandry industries such as planting, animal husbandry, and agricultural product processing. It comprehensively analyzes the energy consumption structure, energy utilization efficiency, and existing energy use problems, with the purpose of providing a scientific reference for the formulation of policies to improve and enhance energy use in Xizang's agricultural and animal husbandry industries.

3. Research Method

3.1. Design of Research

In response to the fact that the research objects involved in this survey work cover a wide range of regions and multiple industry segments, the project team has discussed multiple times and proposed to use a combination of quantitative and qualitative methods to carry out this research work. By conducting on-site questionnaire surveys in Nyingchi, Lhasa, and Shigatse, energy consumption data in the agricultural and animal husbandry industries were collected and analyzed, highlighting the objectivity, measurability, and statistical inference of the survey data. Based on the research results, collect and analyze non numerical data (such as text and images) to highlight the significance and effectiveness of this research work.

(a) Questionnaire survey work: The project team distributed 120 survey questionnaires to agricultural science

and technology parks, farmers and herdsmen, village level cooperatives, and processing enterprises in Linzhi, Lhasa, and Shigatse, and effectively collected 118 questionnaires (with a response rate of 98.3%). (b) Conduct on-site interviews: Conduct field research in 12 townships of three cities, interviewing a total of 32 farmers, herdsmen, technical personnel, and relevant management personnel. (c) Conducting data analysis work: Through this research, energy consumption data from Linzhi, Lhasa, and Shigatse over the past five years were collected, and an energy analysis model was established.

3.2. Scope of Research

In order to objectively reflect the validity of the survey data, the project team actively overcame objective factors such as transportation and geography, and conducted research in three regions: Nyingchi, Lhasa, and Shigatse. After statistical analysis of the distribution ratio of the research areas (as shown in Figure 1), it was determined that the significance of this survey research work could be objectively reflected.

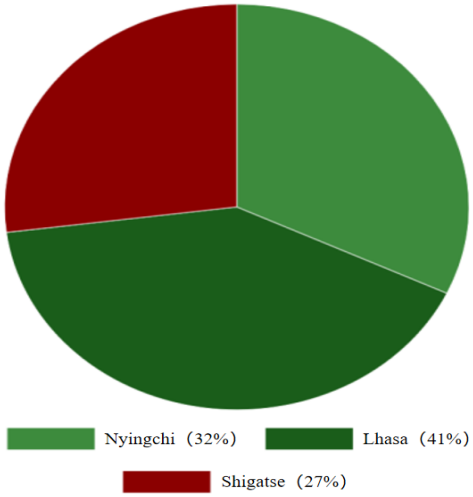

Figure 1. Proportion of sample distribution in the study area

4. Data Analysis of Energy Consumption Status

4.1. Comparison of Energy Consumption Structures

Linzhi City is located in the the Yarlung Zangbo River basin in the southeast of Xizang. Due to its unique geographical location and warm and humid climate, the annual precipitation can reach 1000 mm. Therefore, the popularity of small hydropower in Linzhi is high, but the seasonal fluctuations of energy are large. According to the survey results, the total energy consumption in the agricultural and animal husbandry industry in Linzhi area has reached 97000 tons of standard coal in the past five years. The main energy supply methods include biomass energy, electricity, diesel, etc. Among them, biomass energy accounts for about 40%, electricity accounts for about 20%, and diesel accounts for about 25% [1].

Lhasa is located in the middle of the Qinghai Tibet Plateau and the north of the the Himalayas. It has a typical plateau temperate semi-arid climate. With the policy support of the autonomous region government to vigorously promote the development of the Qingji energy industry, the clean energy infrastructure construction in Lhasa has been relatively complete in recent years. However, due to factors such as transportation conditions, there still exists a problem of high energy costs. According to the survey results, the total energy consumption in the agricultural and animal husbandry industry in Lhasa in the past five years has reached 158000 tons of standard coal. The main energy supply methods include electricity, solar energy, biomass energy, etc. Among them, electricity supply accounts for about 28%, diesel supply accounts for about 22%, and biomass energy supply accounts for about 30% [1].

Shigatse is located in the southwest of the Xizang Autonomous Region, at the north foot of the the Himalayas, the confluence of the the Yarlung Zangbo River and its main tributary, the Nianchu River (river valley), and belongs to the arid climate of the plateau temperate zone. Shigatse, known as the granary of Xizang, is the most important agricultural production base in the autonomous region. Its agricultural output value and grain output have long ranked first in Xizang, so the scale of agriculture and animal husbandry is large and the demand for energy is high. Due to its unique geographical and climatic environment, there is also a problem of unstable energy supply. According to the survey results, the total energy consumption in the agricultural and animal husbandry industry in Shigatse region has reached 182000 tons of standard coal in the past five years. The main energy supply methods include biomass energy, diesel, solar energy, etc. Among them, biomass energy accounts for about 35%, diesel energy accounts for about 17%, and electricity energy accounts for about 24% [1].

Based on the survey and statistical results of energy consumption in Linzhi, Lhasa, and Shigatse, a comparative analysis of the energy consumption structure of agriculture and animal husbandry in the three regions was conducted, as shown in Figure 2.

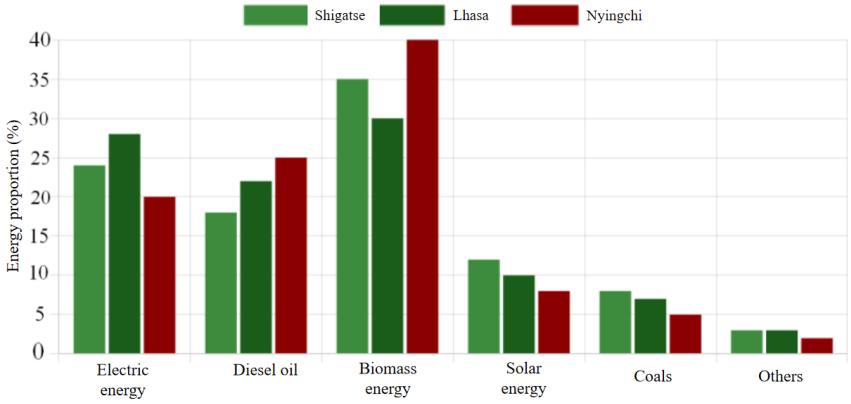

Figure 2. Comparison of Energy Consumption Structures in Linzhi, Lhasa, and Shigatse (%)

4.2. Comparison of Energy Consumption Per Unit Output Value

By querying the average gross domestic product (GDP) of planting, animal husbandry, and agricultural product processing industries in Linzhi, Lhasa, and Shigatse over the past five years [1, 2], as well as the energy consumption of corresponding industries, the energy consumption per unit output value of the corresponding industries was calculated and summarized in Table 1. It can be seen that the planting industry has the lowest energy consumption per unit output value among the three industries; The unit energy consumption of agricultural product processing industry is the highest. In addition, influenced by the geographical and environmental factors of the three regions, the energy consumption per unit output of planting, animal husbandry, and agricultural product processing industries in Linzhi area is lower compared to the other two regions.

Table 1. Comparison of energy consumption per unit output value in Linzhi, Lhasa, and Shigatse

Areas	Planting industry (ton of standard coal/10000 yuan)	Animal husbandry (ton of standard coal/10000 yuan)	Agricultural product processing industry (ton of standard coal/10000 yuan)	Comprehensive energy consumption (ton of standard coal/10000 yuan)
Nyingchi	0.45	0.62	0.78	0.58
Lhasa	0.52	0.70	0.85	0.67
Shigatse	0.48	0.65	0.80	0.62

4.3. Distribution of Service Life of New Energy Equipment

To understand the efficiency of the use of new energy in the agricultural and animal husbandry industry, statistics were conducted on the service life of common new energy equipment such as solar water heaters, solar street lights, photovoltaic water pumps, and distributed photovoltaic power stations in the agricultural and animal husbandry industries in Linzhi, Lhasa, and Shigatse. The statistical results are shown in Figure 3. According to the statistical results, it can be seen that the proportion of new energy equipment with a service life of 5-8 years is the highest in Linzhi area, while the proportion of new energy equipment with a service life of 9-12 years is the highest in Lhasa and Shigatse areas [3].

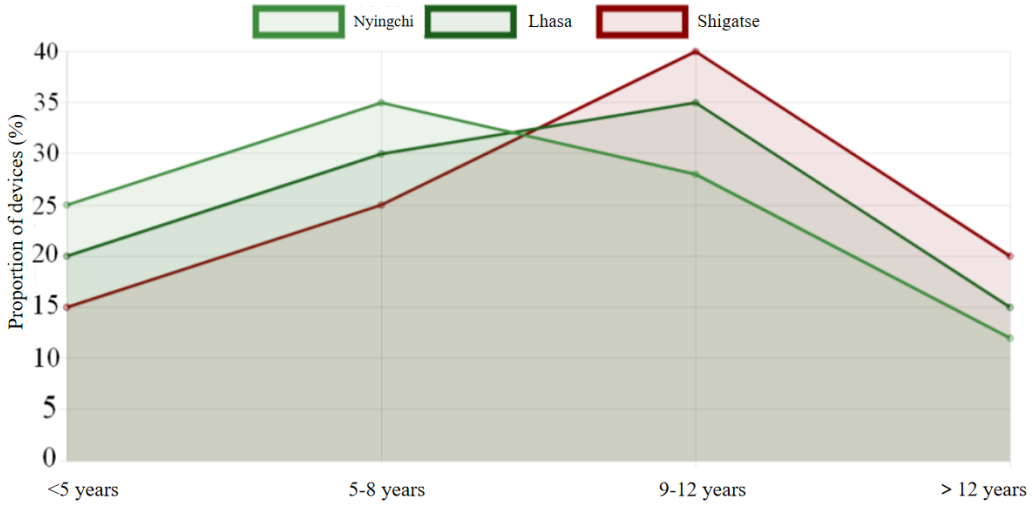

Figure 3. Statistical Distribution of Service Life of New Energy Equipment

4.4. The Application and Efficient Use of Clean Energy

In order to understand the energy consumption structure of farmers and herdsmen, a survey and statistics were conducted on the solar energy usage of farmers and herdsmen in Nyingchi, Lhasa, and Shigatse. The statistical results are shown in Figure 4. According to the statistical results, only about 38% of farmers and herdsmen use solar energy equipment.

In order to understand the issue of energy utilization efficiency, a survey and statistics were conducted on the utilization of biomass energy in the agricultural and animal husbandry industries in Nyingchi, Lhasa, and Shigatse. The statistical results are shown in Figure 5. According to research, there are efficient ways to utilize biomass energy in Lhasa and Shigatse, such as compressed and dried cow manure storage and combustion, high-quality combustion furnaces, as well as biomass heating, water supply and utilization methods. Similarly, there are also ways to abandon cow manure, firewood and other biomass energy in the suburbs of some towns in Nyingchi and Lhasa, and instead use more convenient high-value energy sources such as natural gas and liquefied gas. According to statistics on the utilization of biomass energy in the three regions, the proportion of efficient utilization of biomass energy is only about 15%.

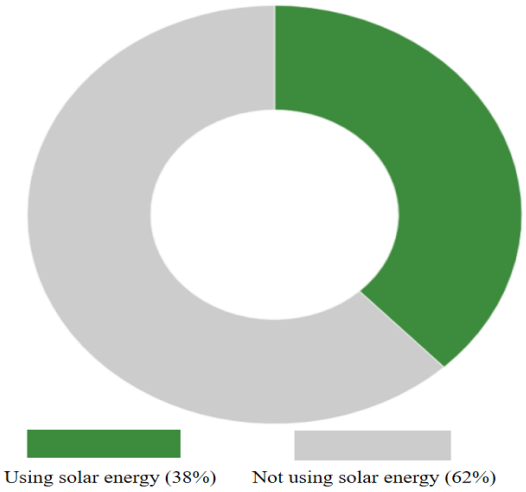

Figure 4. Utilization rate of solar energy equipment in farmers and herdsmen

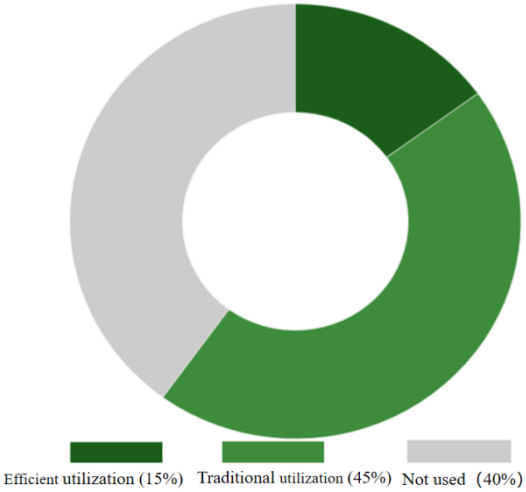

Figure 5. Utilization of Biomass Energy (Livestock Manure)

5. Existing Energy Consumption Issues

5.1. Problems in Energy Supply

Through research, it was found that there is a widespread phenomenon of unstable power supply in the agricultural and pastoral areas of the three regions, especially in the remote pastoral areas of Shigatse, where the average annual power outage time exceeds 180 hours. Due to insufficient power grid coverage, 42% of herdsmen still rely on distributed photovoltaic power generation, diesel generators and other energy supply equipment to meet their energy needs, resulting in low energy supply guarantee rates and high energy costs [4].

5.2. Problems in Ensuring Efficiency of New Energy

The failure rate of new energy equipment is high, and the equipment is generally in disrepair over time [5]. The energy supply system is severely aging. The average service life of new energy equipment and facilities in the three regions is not long, especially in the past two years when the country vigorously promotes the development of new energy applications. Many new energy equipment and facilities such as solar street lights, solar water heaters, and solar heating systems have been newly built. However, more than 35% of the equipment has system operation problems and is not maintained in a timely manner. Solar photovoltaic equipment generally has the problem of "heavy installation, light maintenance", resulting in a new energy guarantee efficiency of less than 30%.

5.3. Problems with Energy Structure

Through research in Nyingchi, Lhasa, and Shigatse, it was found that the utilization of traditional biomass energy (cow manure, firewood) still accounts for a high proportion of 42.5%, while the application of clean energy is low, especially in relatively remote agricultural and pastoral areas where the proportion of traditional biomass energy in household energy consumption exceeds 70% [4].

5.4. Problems in Operation and Maintenance Management

Research has found that there is a serious lack of professional energy management personnel in all three regions. 75% of the surveyed cooperatives have not established energy management systems, and farmers and herdsmen have weak awareness of energy conservation. The coverage of energy-saving technology training is less than 30%, resulting in many new energy equipment and facilities being unable to provide energy supply and security.

6. Suggestions

6.1. Optimize Energy Utilization Structure

Implement the "Light Pastoral Complementary" project to promote the application of photovoltaic water lifting, photovoltaic heating, and other technologies in pastoral areas; Constructing distributed biomass energy stations to achieve the resource utilization of livestock manure; Developing the "photovoltaic+greenhouse" model in agricultural areas to improve land use efficiency [6].

6.2. Equipment Updates and Technology Promotion

Establish special subsidies for energy-saving equipment in agriculture and animal husbandry, and promote the upgrading of high-efficiency energy-saving equipment; Establish a three-level energy-saving technology service network (county service center township service station village service point); Promote intelligent irrigation systems and strive to increase the energy efficiency ratio of efficient water-saving irrigation and efficient agricultural and sideline product processing to 50% within five years [7].

6.3. Improve the Infrastructure of The Power Grid

Implement the rural power grid consolidation and upgrading project, focusing on solving the power supply problem in remote pastoral areas; Developing microgrids and energy storage technologies to improve power supply reliability; Explore the integrated power supply mode of "grazing, light, and storage".

6.4. Policy Guarantee

To formulate a special plan for the application of clean energy in agriculture and animal husbandry in Xizang; Improve the policy of electricity price subsidies; Incorporate energy management into the training system for new professional farmers and herdsmen; Establish a monitoring platform for energy consumption in agriculture and animal

husbandry.

7. Conclusions

The paper systematically analyzes the current situation and existing problems of energy use in agriculture and animal husbandry in Linzhi, Lhasa and Shigatse, Xizang. Research has shown that the unreasonable energy structure, low efficiency of energy equipment utilization, and inadequate management mechanisms in the three regions are the main factors restricting the sustainable development of agriculture and animal husbandry.

To address these issues, it is recommended to adopt a regional and phased optimization strategy: the Linzhi area can focus on developing complementary systems of small hydropower and solar energy; The complementary model of agriculture and photovoltaics can be promoted in the suburban areas of Lhasa; The remote agricultural and pastoral areas in Shigatse can prioritize solving the problems of power grid coverage and the application of mobile photovoltaic equipment. Through a combination of optimizing energy structure, upgrading technological equipment, and innovating management mechanisms, it is expected that by 2030, the proportion of clean energy supply in the agricultural and animal husbandry industries in the three regions can be effectively increased, and the energy consumption per unit output value can be significantly reduced.

The research results of this paper have important practical value in promoting the green and low-carbon transformation of Xizang's agriculture and animal husbandry, achieving the win-win goal of ecological protection and income increase of farmers and herdsmen, and providing a scientific basis for formulating energy policies in Xizang's agricultural and pastoral areas.

Acknowledgment

"Investigation on the Current Situation of Energy Use in Xizang's Agriculture and Animal Husbandry Sector and Academic Exchange Activities on Exploring Clean Energy Use Paths" (XZKXXM2025-16)

References

[1] Xizang Autonomous Region Bureau of Statistics Xizang Statistical Yearbook 2025 [M]. Beijing: China Statistics Press, 2025.

[2] National Energy Administration China Rural Energy Development Report 2025 [R]. Beijing: China Electric Power Press, 2025.

[3] Wang Lixin, Li Qiang Research on Energy Utilization Efficiency of Agriculture and Animal Husbandry in Plateau Areas [J]. Journal of Agricultural Engineering, 2025, 41 (3): 112-118.

[4] Xizang Academy of Agriculture and Animal Husbandry Analysis on the application prospect of Xizang clean energy in agriculture and animal husbandry [R]. Lhasa: Xizang Science and Technology Press, 2024.

[5] Chen Minghua et al Evolution and optimization path of energy consumption structure in agricultural and pastoral areas of Xizang [J]. Resource Science, 2025, 47 (2): 245-256.

[6] International Energy Agency. Renewable Energy for Agriculture [R]. Paris: IEA Publications, 2025.

[7] Zhang Weiping Comprehensive Utilization Technology of Solar Energy in Plateau Areas [M]. Beijing: Science Press, 2024.