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# Concentration on China's Poultry Manure Power Plants How can the biomass waste industry be marketed?

[1*] **Mrs. Subhasmita chaudhury**, [2] **Mr.NARESH KANUNGO**
[1*] *Asst. Professor, Dept. Of Electrical Engineering, NIT BBSR,*
*Asst. Professor DEPT. of Electrical Engineering, NIT BBSR,*
[1*], subhasmita@thenalanda.com, , nareshkanungo@thenalanda.com

Abstract

With the booming animal husbandry industry, animal waste in agriculture is steadily harming the environment. To meet China's requirements for environmental protection, the production of power from chicken dung is becoming practical and useful. This report examines the state of chicken manure power generation in China today in light of available resources and technological advancements. The study does a PEST-SWOT matrix analysis in conjunction with the policy environment to roughly examine the strengths and weaknesses, the possibilities and challenges. Then, the paper analyzes the distribution of chicken manure and gives some solutions from respects of government regulatory behavior, industri- al-organizational behavior and corporation strategic behavior. Finally, it is concluded that: 1) the government should strengthen policy support by ac- tively improving the subsidy mechanism and lowering the threshold of fi- nancing and credit; 2) enterprises should focus on improving power genera-tion technology and boiler treatment technology.

**Keywords**

Biomass, Chicken Manure, Power Generation, PEST-SWOT, Solutions

## 1. Introduction

At present, China is striving to reach the peak of carbon dioxide emissions by 2030, and to achieve carbon neutrality by 2060. China is less than 10 years away from achieving the peak carbon goal, and only 30 years from the peak carbon goal to the carbon neutral goal, compared with developed countries, China has an extremely difficult task to achieve the peak carbon and carbon neutral goals. The demand for energy growth for economic development and the pressure for carbon reduction coexist, and the development of clean energy is indispensable in improving the energy supply structure and building a national ecological se- curity barrier. Biomass energy, the only renewable energy source, that can be transported, has received extensive attention because of the rich resources and wide geographical distribution [1]. It is reported by the China National Renewa-ble Energy Centre that in 2015, China's biomass power installed capacity reached 10.6 million kilowatts, second only to that of the United States (15.9 million kilowatts) and Brazil (11 million kilowatts) [2]. China's biomass power generation grid-connected capacity reached 29.52

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Vol-10 Issue-3 No.01 March 2020

million kilowatts at the end of2020, up 22.6% year-on-year; the annual installed capacity was 5.43 million ki-lowatts, ranking the first in the world. Meanwhile, due to the development of the chicken industry, the environmental problems caused by chicken manure have become serious increasingly [3]. The excrement of the chicken farm cannot be managed effectively, which causes a series of problems to the surroundings. More importantly, the improper disposal of chicken manure on farms can causepollution to the ground, groundwater and soil, which would damage the ecolog-ical environment at last.

Chicken manure is a high-quality raw material for power generation and its production in China is huge. However, the history of chicken manure power generation in China is relatively short. Noted that the first combustion power plant and biogas power plant using chicken manure as raw materials were put into operation in April 2009 [4]. So far, the installed capacity of China's grid-connected power plant using chicken manure has been less than 100 MW. The handling capacity of chicken manure per year is less than 1% of its total ex-cretion. It can be seen that the utilization rate of chicken manure is at a superfi-cial level, which means chicken manure power generation has much more po- tential for development.

In order to promote the rapid development of clean energy, the Chinese gov-ernment has issued many policies since 2013. The National Development and Reform Commission issued the "Revolution Strategy for Energy Production and Consumption" (2016-2030) in 2016, and clarified that from 2021-2030, new ener- gy demand will be met mainly by clean energy. Total energy consumption will be controlled within 6 billion tons of standard coal. The proportion of non-fossil energy in total energy consumption will reach about 20%, and carbon dioxide emissions per unit of GDP will drop by 60% - 65% compared to 2005. Therefore, the clean energy industry will face major challenges. Although solar energy and wind energy are mainstream clean energy, wind curtailment and solar curtail- ment have frequently occurred in China for more than ten years [5]. In contrast, chicken manure is not only inexhaustible but also stable to provide electrical energy [6]. The development of chicken manure power generation can bring considerable effective environmental benefits as well as economic benefits be-cause of its obvious role in pollution abatement. For all that, as an emerging in-

dustry, chicken manure power generation sector still faces lots of problems to besolved, such as technology innovation and acquisition of raw material and so on[7].

In the PEST-SWOT matrix, strengths, weaknesses, opportunities and threats of chicken manure power generation are analyzed from four aspects: policy, economy, society and technology. According to the requirements of clean ener- gy, it is necessary to consider the factors of supply and demand, technology and environment to make a judgment on the development direction of chicken ma- nure power generation. Through the analysis, this

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paper puts forward some so- lutions on government regulatory behavior and industrial-organizational beha- vior. In the end, combining the comparison of two kinds of power generation technologies and the distribution of chicken manure in various regions of China, the corporation strategic solutions are given.

## 2. Status Quo

### Resource Endowment

### Characteristics of Chicken Manure

The test of the combustion characteristic shows that the mixture of chicken ma- nure and rice husks can produce 10.45 MJ/kg lower heating value, half of the raw coal [8]. And the carbon-nitrogen ratio of chicken manure is 15.6 to 1, which isvery high. The calorific value of biogas is 23 - 24.3 MJ/$m^3$ so that 1 $m^3$ of biogasis equivalent to 3.3 kg of raw coal [9].

### Production and Distribution of Chicken Manure

The chicken manure emission factors are from First National Survey of Pollu- tion Sources of Livestock and Poultry Livestock Production Sewage Coefficient Manual, in which layers are 0.12 kg/day and broilers are 0.14 kg/day. Based onthe number of layers and broilers in the China Agricultural Statistics 2018, it can be calculated that chicken manure production reached 287.31 million tons in the country. Chicken manure volume and distribution density in each province (mu-nicipal city, autonomous region) are displayed in **Figure 1**.

Chicken manure volume is calculated according to the following formula [10]:

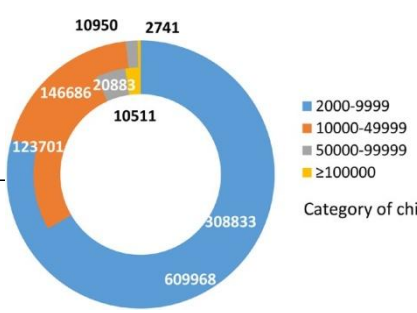
$$W_F = H_L \times F_D \times T_D \times 1000 \quad /$$

$W_F$: chicken manure annual emission (million tons);

$H_L$: the number of layer stock and broiler stock (ten thousand); $F_D$: the chicken manure emission factor (kg/day/per capita); $T_D$: feeding days.

In the last decade, China's chicken industry has developed rapidly from the scale of farming to the level of production. Based on the basic statistical data in the China Animal Husbandry and Veterinary Statistical Yearbook 2007 and China Animal Husbandry and Veterinary Statistical Yearbook 2018, there weremore than 30,000 chicken farms with more than 50,000 chickens in 2017. In 2006, there were less than 10,000 chicken farms of this size. The number of farms of various sizes in 2006 and 2017 is displayed in **Figure 2** (The inner and

**Figure 1.** Provincial ranking of total output and density of chicken manure (2017).



ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

**Figure 2.** The number of chicken farms of various sizes (2006, 2017).

outer rings are the number of chicken farm households of different sizes in 2017 and 2006, respectively).

Compared to 2006, the total number of farms and large-scale farms increased significantly in 2017, as can be seen in **Figure 2**. This shows that the chicken indus-try has an increasingly high degree of intensification. The number of large-scale farms with an annual chicken slaughter above 500,000 in each province (municipalcity, autonomous region) is displayed in **Figure 3**.

## Technical Condition

### Combustion Power Generation Using Chicken Manure

The boiler uses the combustion technology of circulating fluidized bed and adopts low-temperature combustion and segmented air supply to effectively re-duce the $NO_x$ and $SO_2$ generated during combustion, which has gained a great advantage in environmental protection [4]. In addition, the combustion by-product of the boiler contains high organic substances such as phosphorus and potassium, which can be used as high-quality compound fertilizer [11]. The value chain of combustion power generation using chicken manure is displayedin **Figure 4**.

**Figure 3.** Provincial distribution of large-scale chicken farm in China (2017).

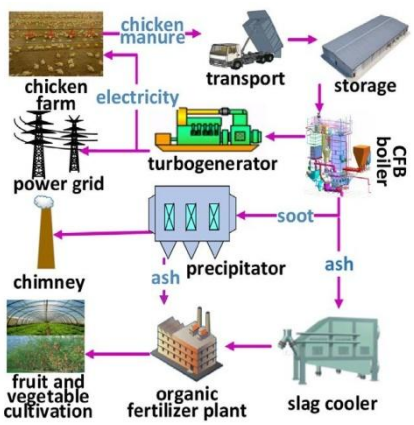



**Figure 4.** Value chain of combustion power generation using chicken manure.

### Biogas Power Generation Using Chicken Manure

Biogas power generation uses methane produced by mixing chicken manure with farm sewage and crop straw as fuel. And per kilogram of chicken manure can produce 0.37 $m^3$ biogas [12]. The electricity can be used in farms and can bedelivered to the grid. At the same time, the thermal energy generated during the electricity generation process will be used for the fermentation system to keep warm and provide heat to the chicken farm in winter [13]. The value chain of chicken manure biogas power generation is displayed in **Figure 5**.

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

### Installed Capacity

According to the data released by the National Energy Administration, in 2020, China's biomass power generation grid-connected installed capacity reached 29.52 million kilowatts, an increase of 22.6% [14]. However, the installed capac-ity of chicken manure power generation is very small, and the current chicken

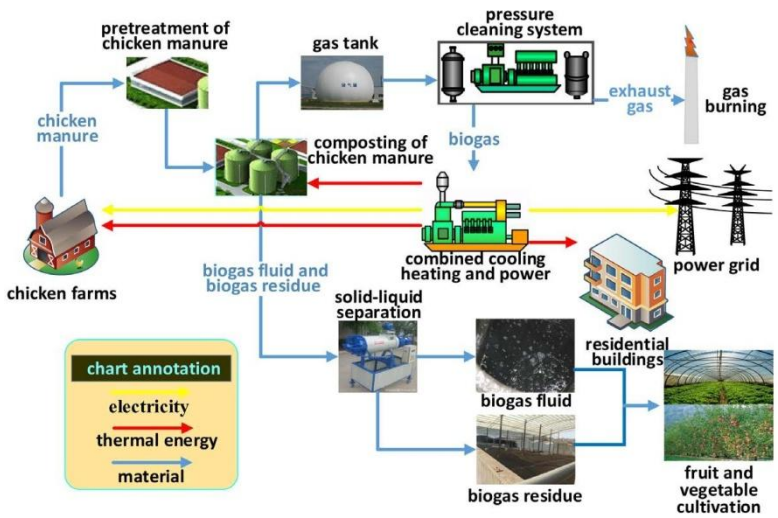



**Figure 5.** Value chain of biogas power generation using chicken manure.

manure combustion power generation and chicken manure biogas power gener-ation is only tens of thousands of kilowatts, and chicken manure is a kind of manure that produces less gas than other livestock manure [14].

At present, there are three main ways to recycle chicken manure in the world: energy, fertilizer and feed. In western developed countries, power generation is an important way of using chicken manure. In China, however, it is fertilizer, and the proportion of power generation is very small. It can be learnt in **Figure 6** [15].

## 3. Methodology: PEST-SWOT Analysis

Combining the industry status of chicken manure power generation, this article analyzes the strengths, weaknesses, opportunities and threats of the industry from the four aspects of policy (P), economy (E), society (S) and technology (T). The analysis matrix is displayed in **Figure 7**.

### Policy Factor Analysis

### Policy Opportunities

In the "13th Five-Year Plan for Renewable Energy Development", it was pro- posed that

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

"improve the price, taxation and other preferential policies to support the development of biomass energy". Also, since 2010, the government has succes- sively issued the "National Development and Reform Commission Circular on the Management of Biomass Power Generation Project Construction", "Guidance on Promoting the Development of Biomass Energy Heating" (2017) and so on. All of these policies can clarify the status of the biomass power generation industry and promote the development of chicken manure power generation enterprises directly [16] [17] [18].

### Policy Threats

1) Emission standards are not clear

**igure 6.** Utilization of chicken manure in China.

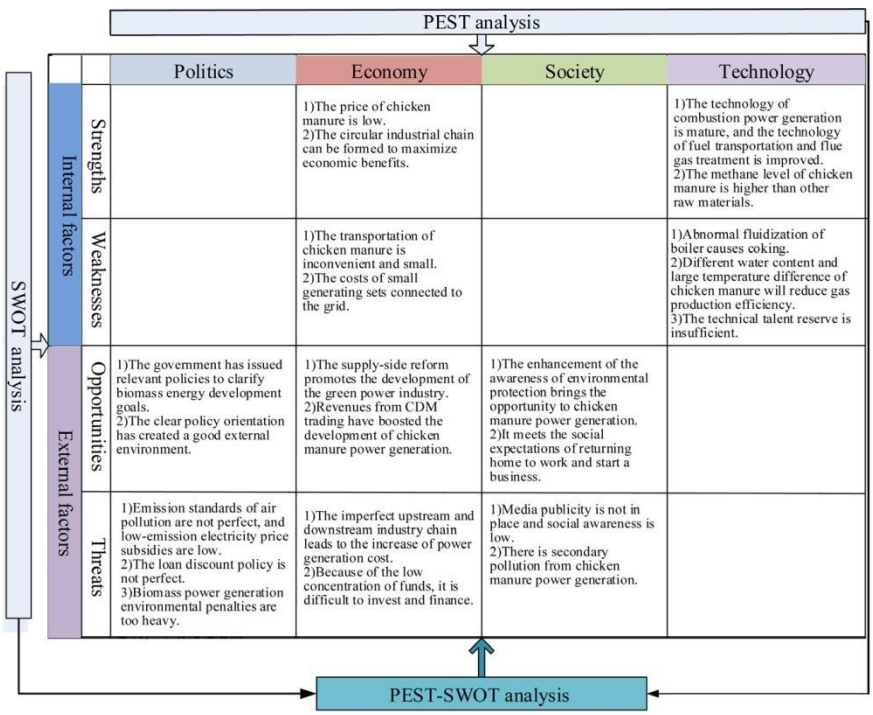



**Figure 7.** PEST-SWOT analysis matrix.

Firstly, China has not yet set emission standards specifically for the biomass power generation industry. The current standards for the emissions from agri- cultural and forestry biomass power generation are implemented according to that of the coal-fired power generation, which is unfair for environmentally sig- nificant biomass power generation. Secondly, the biomass power companies have invested significant amounts of capital to achieve ultra-low emissions, but they are unable to enjoy electricity price subsidies in time [19]. Moreover, bio- mass power generation is plagued by technological lags, and many companies are unable to reach the continuously updated ultra-low emission level, which makes them unable to obtain subsidies for reducing emissions [20].

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Vol-10 Issue-3 No.01 March 2020

2) Loan discount policy is not perfect

At present, fewer projects can enjoy the benefits of the loan interest subsidy policy. Chicken manure power generation is an emerging industry encouraged by the government and requires a large amount of capital. However, commercial

banks cannot provide lower loan rates than conventional ones, which makes the financial situation of chicken manure power generation projects more dangerous[21].

## Economic Factor Analysis

### Economic Strengths

Chicken manure is abundant and inexpensive, which can achieve higher eco- nomic benefits than itself when it is energized [22]. Biogas power generation isthe most common method of converting manure into energy. The "chick- en-fertilizer-methane-electricity" recycling industry chain can achieve excellent economic benefits, and it can also save a large number of sewage charges [23]. In another way, the ash left by combustion power generation is high-quality potas- sium and phosphate fertilizer that can be used directly, which eliminates the costs of ash delivery and storage [24].

### Economic Weaknesses

Although the chicken manure production is massive in China, the distribution is not concentrated. The high transportation cost of chicken manure is an essential factor that restricts the power generation [25]. Chicken manure power genera- tion needs enormous investment, and capital recovery is slow. Moreover, in- vestment in emission reduction is huge [26].

### Economic Opportunities

1) Industrial economy upgrade

At present, the environmental carrying capacity of China has approached the upper limit, and new ways are urgently needed to promote low-carbon de- velopment. The "Revolution Strategy for Energy Production and Consump- tion" (2016-2030) clear that, in combination with new-type urbanization and agricultural modernization, China will expand the scope of electricity use, give priority to the use of renewable energy power, simultaneously promote electrifica- tion and information technology construction, and open up a new era of fu- ture-oriented energy consumption [27]. As an important project for capacity reduction, chicken manure power generation can promote the sound develop- ment of circular economy.

2) Carbon emission trading

The greenhouse gas produced by burning chicken manure is about 25% of it produced by burning coal [4]. Moreover, greenhouse gas emissions from biogaspower generation are close

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Vol-10 Issue-3 No.01 March 2020

to zero. Most importantly, the project can also obtain the Clean Development Mechanism (CDM) income. For example, Sunner Com- pany obtains 100 million yuan by processing 700,000 tons of chicken manure annually [28]; Shandong Minhe Stock Co., Ltd. also obtained CDM transactionbenefit from biogas power generation [29].

### Economic Threats

1) Investment and financing difficulties

Chicken manure power generation is less capital intensive than traditional power generation projects so that investors are more cautious about investing in the project. In particular, it is often located in rural areas or suburbs, where fi- nancing is difficult [30].

2) Transportation and supply bottlenecks

Compared with coal-fired power generation, biomass power generation projects are environmentally friendly and renewable, but the collection costs are huge [31]. Besides, the quality and supply efficiency of raw materials have re- stricted the development of China's biomass energy industry to some extent [32].

### Social-Natural Factor Analysis

### Social-Natural Opportunities

1) Better environmental awareness

With the advancement of society, citizens' awareness of emission reduction has gradually increased. Besides, enterprises have begun to use energy-saving equipment to reduce electricity consumption, and the government has also adopted restrictions on high-energy-consuming projects, which has contributed to the promotion of chicken manure power generation with low-carbon [33].

2) Providing employment opportunity

In recent years, the trend of rural migrant workers returning home for em- ployment or entrepreneurship is noticeable. The development of the chicken manure power generation industry is conducive to promoting the development of the chicken industry, which can provide more employment opportunities forfarmers [34].

### Social-Natural Threats

1) Low cognition degree of society

Since chicken manure power generation has just emerged in China, and the media has reported very little on it. People are surprised by this type of power generation, and few investors have noticed it, which is an important reason whyit has not been widely promoted [35].

2) Secondary pollution

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

At present, there is no standardized system for the operation of chicken ma- nure power generation project in China, and secondary pollution exists in the production process. On the one hand, pollutants may leak during transporta- tion. On the other hand, how to make full use of the large amount of biogas and ash produced by combustion is a problem to be solved [36].

### Technological Factor Analysis

### Technological Strengths

1) Combustion power generation technology

Compared to conventional coal power, combustion power generation does not require a crushing and milling system. It only requires some conventional

system, such as the combustion system, circulating cooling water system and thermal system. However, fuel delivery and ash collection are the main concerns that need attention. It is worth mentioning that the ash collection adopts two-stage dust removal technology, which can collect nearly 99% of the dust [37].

2) Chicken manure fermentation technology

A mixture per kilogram of chicken manure and straw produces 0.37 $m^3$ of biogas with a methane content of 54%, and raw material digestibility is about 65%. It can achieve higher natural gas production than other biomass fermenta- tion materials [38].

### Technological Weaknesses

At present, there are certain technical defects in the boilers developed in China. The slag tends to block the discharge port, and the fluidization boiler sometimes fails to cause coking, resulting in insufficient output. Moreover, the accumula- tion of ash on the surface of the back-end flue is severe, considering the special fuel characteristics and smoke composition of chicken manure [39].

Due to seasonal changes and weather changes, the water content of chicken manure is variable, and this change reduces the efficiency of starter culture. Be- sides, biogas fermentation temperature is mainly at medium-temperature (about 37˚C). However, the temperature in the north of China is generally low in winter and spring, which significantly limits the gas production rate of biogas [40].

## 4. Results and Discussion

Based on the introduction of the industry's status and the PEST-SWOT matrix analysis, in the chicken manure power generation sector, it is demonstrated that some practical problems need us to solve. In order to promote the positive de- velopment of the sector, this section gives some solutions in three aspects: gov- ernment regulatory behavior, industrial-

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

organizational behavior and corpora- tion strategic behavior. As displayed in **Figure 8**.

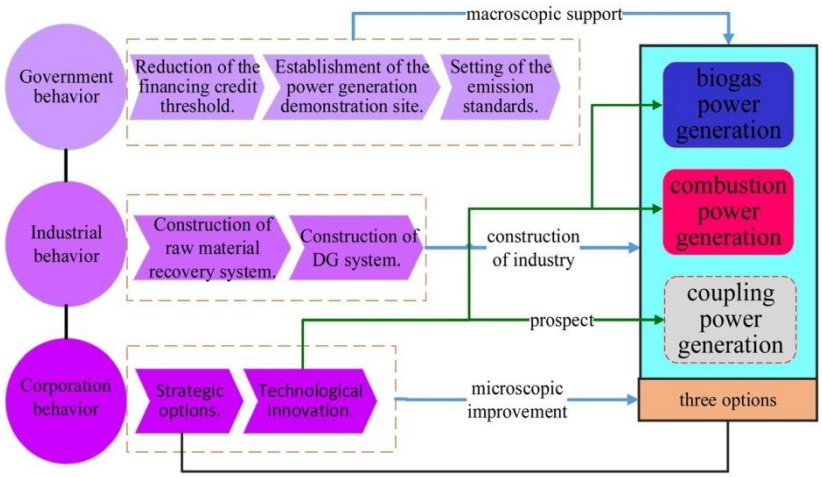


**Figure 8.** Logical diagram of the solution.

## Government Regulatory Behavior

### Reduction of the Financing Credit Threshold

Government agencies should lower the threshold for financing credit and estab- lish a complete competition mechanism between the same industry, which can implement a differentiated credit system. In order to make direct financing be- come the main channel for chicken manure power generation companies, a comprehensive diversified and multi-level capital market system should be es- tablished. Also, it is proposed to form a new policy financial organization to provide financing services for strategic emerging sectors.

### Establishment of the Power Generation Demonstration Site

The demonstration and promotion of this power generation technology have the nature of quasi-public products. Therefore, it is advisable to establish chicken manure power generation demonstration sites in provinces with a well-developed poultry industry, in order to solve the difficulty of technology promotion and the high cost of operation. It also helps promote the vigorous development of farming entities and other investment entities in the vicinity of power generation projects.

### Setting of the Emission Standards

It is recommended to issue environmental emission standards for the chicken manure power generation sector. Due to the specificity of the components con-tained in chicken manure, it should not be measured by coal-fired emission standards. For the long-term development of the sector, appropriate emission standards should be formulated according to the level of development. Such an approach can avoid unreasonable losses caused by policies and taxes.

In addition, due to seasonal changes, some characteristics of chicken manure composition

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

and gas emissions may be slightly different. To reduce the tax pressure of those companies, it is suggested that punishment for environmental pollution should be decoupled from the Value Added Tax (VAT) rebate.

### Industrial-Organizational Behavior

#### Construction of Raw Material Recovery System

The problem of a raw material bottleneck in the development of chicken manure power generation sector can be solved through supply chain optimization.

The main purpose of supply chain optimization is to reduce the cost of raw material supply and improve the quality of raw material supply. For the first model described in 3.2.4, e-commerce could be introduced. Farmers can share chicken manure quality standards and prices and other information through the Internet platform to reduce the benefits for brokers. For the second model, it is possible to learn from the practice of Kaidi Eco and establish a storage station incooperation with the village committee to reduce the construction and operation costs of the storage station. For the third mode, farmers can be encouraged to collect and transport chicken manure to enterprises by appropriately increasing the price of chicken manure. In a word, the key to supply chain path optimiza-

tion is that enterprises should master the dominance of the supply chain and can enhance the enthusiasm of all parties involved in the storage and transportationof raw materials.

#### Construction of Distributed Generation System

With the advancement of urbanization and distributed energy technology, dis- tributed power generation based on biomass power has great potential. Most chicken farms are built in rural areas or around towns near the countryside, where per capita resource occupation and energy demand have increased signif- icantly. Chicken manure power generation is in line with the characteristics of integrated generation and utilization of distributed power generation. Based on the comprehensive utilization of chicken manure biomass, it can constitute a distributed renewable energy system combining multiple uses such as gas pro- duction, power generation, and heating. Due to sufficient raw materials, the sys- tem is stable enough to support the electricity demand of residents in rural or small-medium cities, which also can reduce environmental protection pressure.

### Corporation Strategic Behavior

#### Strategic Options

This section compares the characteristics of the two types of power generation, especially the raw material consumption and emission levels. According to the distribution of raw materials in the country, the most efficient power generationmodes in each region are given.

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

1) Comparison of two types of power generation

Based on the industry status and PEST-SWOT matrix analysis, the characte- ristics of the two types of power generation modes can be derived, as displayed in **Table 1**.

2) Selection of strategic scheme

The grading standard for the total amount and distribution density of chicken manure are displayed in **Table 2**, which was determined by using the "three-equidistant intervals method" [10].

**Table 1.** Comparison of two generation modes of chicken manure.

| Type of power generation | Features | Advantage | Disadvantage |
|---|---|---|---|
| Combustion power generation | The fuel burns in the boiler and the steam generated drives the turbine. | Mature technology; Large scale; Simple fuel treatment; Low operating costs. | Low emissions; high efficiency; Wide range of capacity; Small initial investment. |
| Gas power generation | The fuel is fermented to produce biogas, which is purified and burned, and then drives an internal combustion engine or a gas turbine. | High cost for emission reduction; Poor fuel adaptability; Large initial investment. | Complex system; The technology of large capacity units is not yet mature; High operating costs. |

**Table 2.** Grading standard of total amount and distribution density.

| Density degree | High | Mid | Low |
|---|---|---|---|
| The total amount of chicken manure (Ten thousand tons) | ≥1400 | 320 - 1400 | ≤320 |
| The distribution density of chicken manure ($kg/hm^2$) | ≥800 | 300 - 800 | ≤300 |

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

Taking the total amount of chicken manure as the abscissa and the distribu- tion density of chicken manure as the ordinate to make the matrix diagram dis- played in **Figure 9**. The total amount of chicken manure and its distribution density is displayed in **Figure 1**. According to the grading standard given in **Ta- ble 2**, 31 provinces (municipal cities, autonomous regions) in the country are divided into 9 parts and are listed in **Figure 9**.

According to the matrix, this study divides the distribution of chicken manure in 31 provinces (municipal cities, autonomous regions) into three major types. And the strategic choice of the enterprise is displayed in **Figure 10**.

The first category is the areas with a high abundance of chicken manure, in- cluding high quantity-high density areas, high quantity-medium density areas and medium quantity-high density areas, totaling ten provinces, as displayed in **Figure 9**. In these ten provinces, the total chicken manure was 202 million tons in 2017, accounting for 70.30% of the national total, and the chicken manure distribution density was 1047.42 kg/hm$^2$ in 2017, which is 2.48 times higher than the national average density. This type of area can be used as a critical develop- ment area for chicken manure power generation throughout the country, where high-density areas are suitable for the development of combustion power gener- ation or large-scale biogas power plants.

The second category is the areas with a generally available abundance of chicken manure, including high quantity-low density areas, medium quanti- ty-middle density areas, and low quantity-high density areas with a total of eight provinces. In these eight provinces, the total amount was 83.72 million tons in 2017, accounting for 29.14% of the national total, and the chicken manure availability distribution density was 148.27 kg/hm$^2$, which was 49.3% of the na- tional average density. High density areas in this type of category, such as Tian- jin, have higher requirements for environmental protection. The biogas power generation project is carried out in the area, which is conducive to improving the environmental management of the farm. Moreover, other provinces in this cat- egory can be developed as biogas power generation projects. Coupled power generation can also be considered if boiler conditions permit.

The third category is the areas with a low abundance of chicken manure, in- cluding medium quantity-low density areas, low quantity-middle density areas, with a total of thirteen provinces. In these thirteen provinces, the total amount of chicken manure obtained was 42.11million tons in 2017, accounting for 14.66% of the national total, and the chicken manure distribution density was
61.28 kg/hm$^2$ in 2017, which was equivalent to 20.38% of the national average

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

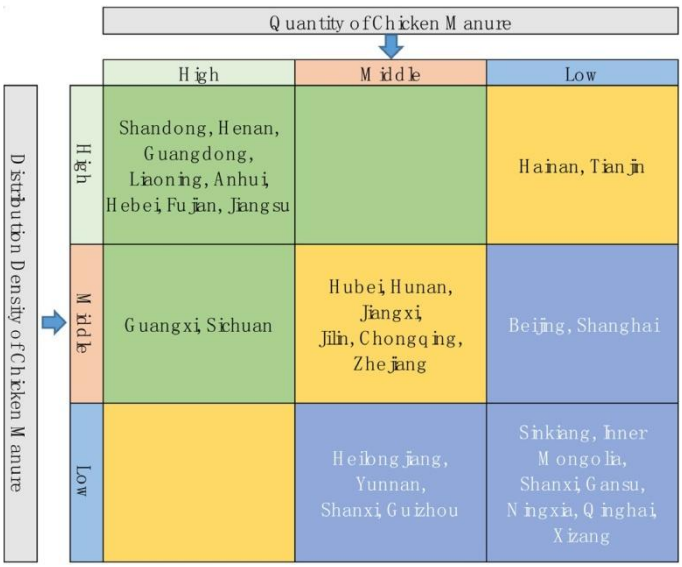


**Figure 9.** Matrix of distribution of chicken manure in Chinese provinces.

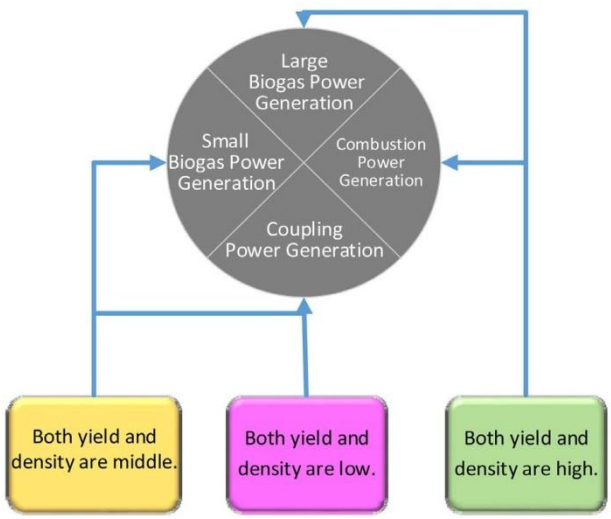


**Figure 10.** Strategic choice of enterprise.

density. Considering the development of new energy sources, this type of area must fully consider the availability of chicken manure. When conditions permit, coupled power generation of chicken manure can be developed [41].

## Technological Innovation

1) Increase of the boiler output

Due to the melting characteristics of chicken manure fuel ash, the combustion temperature in the furnace is from 100˚C to 150˚C, which is lower than that of conventional coal-fired boilers [42]. Therefore, if the chicken-combustion boiler has the same heating area as the

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

coal-fired boiler, it will inevitably lead to the insufficient output. Comparing the state before and after the transformation of the boilers, the removal of the local castable in the furnace can significantly in- crease the heating area of the furnace. Therefore, the furnace evaporating heat

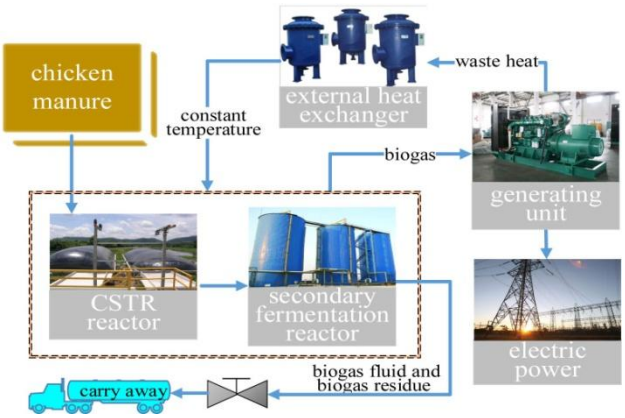


**Figure 11.** Constant temperature model of fermented biogas.

receiving area of the chicken manure boiler is designed more than the conven- tional coal-fired circulating fluidized bed boiler, so that the design output can beachieved.

2) Fermenter thermostatic system design

In order to ensure that the biogas fermenter can maintain a constant temper- ature and produce a sufficient amount of gas in winter, it is necessary to design a constant temperature system. Installation of the biogas fermenter in a sealed building with an air interlayer. Due to the relatively small thermal conductivity of air, it is suitable for heat preservation. The "gas-heat-constant temperature-gas"process is displayed in **Figure 11**. The waste heat generated by the biogas power generation heats the CSTR reactor and the secondary fermentation reactor through an external heat exchanger, thereby maintaining a high level of medium temperature gas production efficiency.

## 5. Conclusions

Chicken manure power generation is a vital renewable energy resource, featur-ing in green, low-carbon, clean and renewable. The development of chicken manure power generation is a crucial measure to improve environmental quality and develop a circular economy, which is of great significance for achieving the goal of low carbon development and energy transformation. Based on the analy- sis of this paper, the following main conclusions are drawn:

Firstly, in China, chicken manure power generation sector is still in its early stages of development, but related power generation technologies are almost mature. At present, many chicken manure generators are in operation and have excellent economic and

ISSN: 2278-4632
Vol-10 Issue-3 No.01 March 2020

environmental benefits. With the rapid expansion of the scale of chicken industry and the continuous reduction of the cost of collecting chicken manure, the promotion of the chicken manure power generation indus- try will be successful. Through the PEST-SWOT matrix, this paper conducts a comprehensive analysis of combustion power generation and biogas power gen- eration industry in terms of policies, economy, society and technology. China has paid more and more attention to the chicken manure power generation in-

dustry, especially in terms of electricity price subsidies and external construction environment optimization. Moreover, China is in the stage of optimization and upgrading of industrial structure. The green power generation industry has a good opportunity for development, and CDM transaction revenue also provides important economic benefits.

Secondly, this article provides some solutions which are suitable for China. To begin with, the government should strengthen policy support by actively im- proving the subsidy mechanism and lowering the threshold of financing and credit. Through the establishment of targeted discharge standards of chicken manure power generation and the construction of raw material recovery systems and demonstration base, the standard of the industry can be achieved. Then, professionals are trained through school-enterprise cooperation. Also, to achieve the purpose of improving power generation efficiency, enterprises should focus on improving power generation technology and boiler treatment technology, such as the design of fermentation tank thermostatic system. Finally, according to the distribution of chicken manure resources in China, a reasonable enter- prise strategy selection scheme is developed. These methods enable us to achieve the highest economic, social and environmental benefits.

Lastly, there are still some problems with chicken manure power generation. The problem of severe dust accumulation in the flue and short operating cycle has not been resolved. It is necessary to analyze the crystallization temperature of chicken manure in light of its chemical characteristics and to design-related technologies. In addition, the standards for the catalyst of chicken manure fer- mentation have not yet formed. Thus, it is urgent to make improvement in rele-vant technologies.

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