Environmental Impact Assessment Report

Project Description: Biogas Engineering Project for Excrement & Sewage Treatment and Resource Utilization

EIA Agency: Shandong Academy of Environmental Science

Legal Representative: Bian Xingyu

Project Description: Biogas Engineering Project for Excrement & Sewage Treatment and Resource Utilization of Shandong Minhe Animal Husbandry Co., Ltd.

Type of Document: Environmental Impact Assessment Report Form

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Shandong Minhe Animal Husbandry Co., Ltd.
Biogas Engineering Project for Excrement & Sewage Treatment and Resource Utilization

Environmental Impact Assessment
Report Form

Director in Charge (Signature):
Department Chief (Signature):

Responsibilities and Duties of Assessment & Review Personnel

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# Project Profile

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<tr>
<td>Legal Representative</td>
<td>Sun Ximin</td>
</tr>
<tr>
<td>Contact Person</td>
<td>Zhang Dongming</td>
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<td>Address</td>
<td>No. 2-3 Nanguan Rd., Penglai, Shandong</td>
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<td>Tel:</td>
<td>0535-5637723</td>
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<td>Project Site</td>
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1. Project Background

1.1. Overview of Livestock and Poultry Breeding Industry

Thanks to the fast growth of more than two decades, the livestock and poultry breeding industry in China has grown into an important pillar industry in its agricultural and rural economy, enjoying a gross output value of more than 1 trillion RMB and accounting for more than 30% of the gross value of agricultural output and 60% or more in some individual provinces and regions. Effectively powered by the growth of animal husbandry, crop farming and processing and other relevant industries and agriculture have witnessed significant development and experienced intensive and extensive growth, resulting in the acceleration of strategic restructuring of agriculture and boost in the income of rural people.

However, the fast growth of livestock and poultry breeding industry in China is also accompanied by environmental pollution worsened by and huge volume of excrement & sewage produced by the livestock and poultry breeding industry. Statistics show that approximately 1.73 billion tons of wastes are produced by the breeding industry each year, approximately 2.7 times the yearly production of 634 million tons of industrial solid wastes. At the present stage, only an extremely small fraction of excrement & sewage discharged by the livestock and poultry farms is put under non-hazardous treatment while the major part of such pollutants are directly discharged, resulting in serious pollution to the surface water, ground water and natural environment and even direct impact on the physical health and quality of life of human being.

Environmental pollution caused by excrement and urine from industrialized livestock and poultry farms has come to a stage that admits of no delay. Efforts should be made to facilitate the treatment of excrement and urine pollution and achieve the scale implementation and commercialization of energy and environment projects. In the face of the environmental pollutions caused by the livestock and poultry breeding industry, the Chinese government has promulgated a series of laws and regulations on pollution control. On March 20, 2001, the SEPA issued the “Management Method for
Prevention and Control of Environmental Pollutions from Livestock and Poultry Raising” (SEPA Order No. 9) and set down in the “10th Five-year Plan” for Environmental Protection as the national objectives to substantially put the pollution from industrialized livestock and poultry breeding under control by 2005, encourage the development of environment-friendly breeding industry and alleviate the worsening pollution of agriculture.

1.2 Overview of the Project Area

On account of the growing efforts in internal agricultural restructuring over the past few years, Penglai witnessed swift growth in its animal husbandry and livestock and poultry breeding industry. There are up to 380 medium-sized pig farms with 3,000 live pigs on hand per year. Every year, Penglai has 140,000 live pigs on hand, 190,000 slaughtered pigs, up to 6 million poultry, including 2.1 million layers, and 23,000 beef cattle on hand.

1.3 Overview of the Project Company

Located on the western outskirts of Penglai, Shandong Minhe Animal Husbandry Co., Ltd. is one of the national and provincial key leading enterprises in agriculture industrialization and a national standardized demonstration zone of export broiler chicken. As an industrialized broiler chicken enterprise with reasonable structuring, state-of-the-art technology and standardized processes in raising parent stock breeding broiler chicken, hatching of breeding eggs and sales of breeding eggs and chickling, feedstuff processing and distribution, breeding of commodity broiler chicken and processing and distribution of broiler chicken, the Company has 1.3 million parent stock breeding broiler chicken (Top 1 scale in China) and 3.7 million commodity chicken (18 million slaughtered per year) on hand, hatches 100 million commodity chicken per year, produces 400,000 tons of feedstuff and slaughters and processes 30 million commodity chicken and 60,000 tons of chicken products. Boasting the best quality and price of young commodity chicken, the Company has 22 breeding chicken farms, 7 hatcheries and 32 production units such as feedstuff plants, commodity chicken industrialization base and food firms. Honored as one of the “National Key Leading Enterprises in Agriculture Industrialization”, “Top 50 Poultry Enterprises in
Asia” and “National Best Poultry Enterprises”, Minhe has obtained the ISO9001 and 2000HACCP certifications for its chicken products, which have been successively honored as “Famous Product on China International Agriculture Expo” and “China Green Food” among others. The “full-process battery breeding technology of broiler chicken” and “auxiliary technology for full-process battery breeding of broiler chicken" independently developed by Minhe won the National Spark Program Award and the Second Prize of Shandong Province Science and Technology Advancement Award while the technology for battery breeding of commodity chicken won the Third Prize of Shandong Province Science and Technology Advancement Award.

II. Project Overview

Adhering to the principle of “clean production, recycling of resources and reduction of pollutants”, the Project shall adopt the concept of “recycle economy” that takes the anaerobic digestion as the core technology in combination with other technologies to realize the biogas-oriented treatment of excrement and sewage so as to achieve the simultaneous supply of biogas, electricity and heat and diversified utilization and harmless treatment of biogas residue and effluent. Renewable energy (biogas, electric energy and heat energy) and organic fertilizers (in solid and liquid states) shall be produced through the treatment of the organic wastewater of high concentration from the chicken farms of Minhe.

Adopting the “recycle economy” concept that takes anaerobic digestion as its core technology in combination with other technologies, the entire solution consists of (1) the pretreatment system, (2) the high concentration and high efficiency anaerobic digestion system, (3) biogas effluent and residue post-treatment system, (4) biogas purification and storage system, (5) biogas power generation and residual heat utilization system and (6) auxiliary buildings and structures, etc.

The proposed Project is designed to treat 500t/d of fresh chicken excrement (with moisture content of around 80%) and wastewater from the washing process and achieve simultaneous power and heat generation using the biogas generator set. All the electricity shall be incorporated into and sold via the external power grid while the residual heat generated by the biogas generator set shall be used as the source of heat to increase the temperature of the anaerobic feed and preserve the heat of the anaerobic cylinder. With a daily and yearly power generation capacity of respectively
30000×1.8=54000 kWh and 19,710,000 kWh, the Project involves a total investment of 63,678,500 RMB ¥ and a unit biogas operation cost and a unit electricity operation cost of respectively 0.5587 ¥/m³ and 0.3106 ¥/m³. The Project shall have 15 fixed staff working 365 days on a three-shift basis and making a yearly income of 13,782,940 RMB ¥.

III. Necessity of Project Construction

All the farms of Shandong Minhe Animal Husbandry Co., Ltd. are located in three zones of Penglai City, respectively referred to as Zone A, B and C (the distribution of which are shown in the Location Map of the Company). Zone A, located in Qujiagou Village, Beigou Town, hosts the biggest share of the breeding activities of the Company while Zone B, on the western outskirts of Penglai City, is adjacent to the Company Headquarters and Zone C is located between Xujiacun and Dazaocun northeast of Penglai City. Every day, 500 tons of chicken excrement and 1,300 tons of wastewater from the washing process of the farms are produced from the three zones, including 1,000 ton for Zone A and 300 ton for Zone B and C. At present, the chicken excrement and washing wastewater from the three zones are discharged into and stored in their respective septic tanks for a certain period of time with the supernatant used for irrigation of the adjacent farm land while the sediments sold to the local farmers as fertilizers. All of the septic tanks are concrete tanks and are subject to proper anti-seepage treatment. The chicken excrement are fully utilized and not discharged to the environment. Odor produced in the course of storage or spillage resulting from nonconforming operation of the transportation vehicles may result in environmental pollution.

As a result of the rapid expansion of the production scale, the existing excrement & sewage treatment technology and capacity are far from satisfying the needs of the production activities and the surrounding living environment, ending up with a vicious circle of the growing breeding business of Minhe. Improperly treated excrement & sewage tend to give rise to diseases while the diseases are carried to the external world by the excrement & sewage and result in execrable environmental impacts. Located on
the west outskirts of Penglai and adjacent to National Trunk Road No. 206, Shandong Minhe Animal Husbandry Co., Ltd. may produce significant impact on the overall environment of Penglai and damage the ongoing efforts of Penglai City in building itself into a modernized and environment-friendly coastal tourist city if the excrement & sewage from the breeding farms are not put under proper treatment.

Zone A, B and C, the three breeding farms of Shandong Minhe Animal Husbandry Co., Ltd., are the key sources of its fresh chicken excrement and washing wastewater. Zone A, which is the biggest one and mainly a broiler chicken farm, is the site of the Project. The chicken excrement from this Zone is directly pumped through the pipeline into the homogenizing grit chamber while the washing wastewater flows by gravity via the sewer tunnel into the screened collecting tank to be provided under this Project for treatment; Zone B is approximately 5km away from the Project Site and the chicken excrement produced from this Zone shall be collected and then pumped into closed tank trucks and transported to the homogenizing grit chamber of the Project for treatment; Zone B is approximately 15km away from the Project Site and the chicken excrement produced from this Zone shall be collected and then pumped into and transported in closed tank trucks to the homogenizing grit chamber of the Project for treatment; 500 tons of fresh chicken excrement (with a moisture content of 80% or so) and 1300 tons of washing wastewater shall be produced by the three zones per day. (The washing wastewater from Zone A shall be treated under this Project while the 300 tons of washing water from Zone B and C which are relatively far from the Project shall not be treated under this Project considering the inconvenience and high cost of transportation of such wastewater).

The 500 tons of fresh chicken excrement produced in the chicken farm each day and the 1000 tons of screened washing wastewater shall be used as raw materials under this large scale biogas project to produce biogas, a high quality biomass energy. In addition to the significant economic benefits, implementation of the project designed for simultaneous production of heat, electricity and fertilizer and biogas power generation shall facilitate efficient reuse and development of agricultural wastes
into renewable energy, promote the quality of agricultural products and the rural environment as well as the progress of agriculture industrialization and create more jobs for the surplus rural labor force and more chances for higher agricultural efficiency, higher income of rural people and sustainable development of rural economy.

Projects aiming at non-hazardous treatment of wastes from chicken farms by reducing the volume of and converting such wastes into resources enjoy extensive prospects and positive social, environmental and economic benefits. The biogas power generation project shall welcome the following benefits upon completion:

(1) Through the anaerobic fermentation of chicken excrement, 30,000 m$^3$ of biogas shall be produced per day and 54,000 kWh of electricity shall be generated per day. With the electricity generated from biogas incorporated into and sold on the power grid at a rate of 0.594 RMB ¥/kWh, an income of 11,707,740 RMB ¥ shall be achieved on a yearly basis;

(2) The heat energy simultaneously generated by the biogas generator set may be used to increase the temperature of the anaerobic tank in winter time to realize intermediate temperature fermentation in the tank for optimal result;

(3) 10,376 tons of biogas residue (with a TS of 75% and a moisture content of 25% or lower through further dewatering in Phase II) and 490,000 tons of biogas effluent may be produced each year from chicken excrement through anaerobic fermentation. The biogas residue and effluent may be used as high-efficiency organic fertilizer to not only reduce the cost of producing organic fertilizer directly using chicken excrement but also to increase the crop yield and obtain environment-friendly and high quality agricultural products free from public hazards relying on the pest and disease prevention functions of such fertilizers.

(4) 104,682 tons of CO$_2$ equivalent may be reduced each year, achieving remarkable environmental benefits.

With the chicken excrement and wastes produced in Minhe chicken farms developed into and utilized as renewable resources at multiple levels through the application of the biogas power generation technology aiming at simultaneous
production of heat and electrical power, high quality gaseous energy and organic fertilizer shall be produced and developed while the pollution shall be put under control and the environment shall be purified thanks to the reduction in the emission of greenhouse gases. Thanks to the multi-level recycling of organic resources and integration of the conversion of energy and cycle of materials involved in the various production processes of livestock and poultry breeding, crop farming and processing industries enabled by biogas, such energy and resources are utilized in higher efficiency, creating a biogas-based benign cycle for the coordination, conversion, renewal and proliferation of livestock and poultry and feedstuff, fuel and excrement and crops and fertilizers under the reaction of microorganism and set an excellent model for control of pollutants from large livestock and poultry breeding enterprises and development and utilization of renewable resources.

IV. Plant Site & General layout plan

The proposed Project Site is located at Qujiagou Village, Beigou Town, Penglai City, Shandong Province in the broiler chicken breeding base of Shandong Minhe Animal Husbandry Co., Ltd. The base is constructed on a foothill site leveled by Minhe for future utilization. Approximately 7.5km southwest of Penglai, the proposed Project is surrounded by flat farmlands and fruit tree land and has Hanwangcun, Wujiacun and other villages in the neighborhood. See Figure No. 1 for the geographical location of the Project Site.

The general layout plan of the Project Site is designed in accordance with the overall planning of Minhe and the technological features of this Project. The Project Site shall consist of three parts north to south, namely, the biogas power generation zone, the anaerobic digestion zone and the biogas effluent storage zone, and also three parts west to east, namely the material pre-treatment zone and biogas power generation zone, the anaerobic digestion zone and the biogas effluent storage zone. The raw material, i.e. the fresh chicken excrement, shall enter the plant area via the northern gate and into the pretreatment section located in the northwestern part of the plant area together with the wastewater from the sewer pipeline and then go into the anaerobic digestion area located in the middle of the plant area. The biogas produced from anaerobic digestion shall be used to generate power in the biogas power
generation zone in the north. Biogas effluent and residue produced through solid-liquid separation shall be respectively stored in the biogas effluent tank and the material warehouse. The (existing) management building is located on the northern end of the plant area and far from the pretreatment zone and thus subject to little odor impact. A ring road shall be arranged in the plant area to separate the various production areas. Two gates are arranged on the north and on the east for the plant area for convenience. The Project shall involve a land occupation of 19,998m² and a building area of 12,312m². See Figure No. 2 for the general layout plan.

V. Technological Process

Taking anaerobic digestion as the core technology and aiming at proper control of excrement & sewage, development of energy and comprehensive utilization of resources, this Project mainly involves two key technological processes, i.e. excrement & sewage treatment and biogas power generation (See the section on engineering analysis for detail). Thanks to the implementation of the Project, excrement & sewage shall be subject to comprehensive treatment and wastes shall be converted into resources and reused to eradicate the sources of pollution, prevent the occurrence of new environmental pollution and thus significantly alleviate the environmental load of the project area.

VI. Economic Benefit Evaluation

1. Cost Calculation

The Project shall involve a total operational cost of 8,998,647RMB¥ (incl. depreciation).

(1) Expenditure on power (E₁)

The Project shall involve an installed capacity of 286.50kW and an actual operation power of 95.72 kW. The electricity price shall be 0.60RMB¥/kWh.

Full-year power consumption = 95.59×24×365 =838507kWh
Full-year expenditure on power (E₁) = 838507×0.60 = 503,100 RMB¥
Equivalent expenditure on power per unit of biogas: 0.046 RMB¥/m³
Equivalent expenditure on power per unit of electricity: 0.026RMB¥/kWh

(2) Cost and transport expenses on materials (E₂)
This Project shall involve a daily excrement treatment capacity of 500 tons. Calculating at a unit cost of 15 RMB ¥/ton and an average transport cost of 2 RMB ¥/ton, the cost and transport expenses on materials shall be:

Annual cost and transport expenses on materials \( (E_2) = 500 \times 365 \times 17 = 3,102,500 \) RMB ¥.

Equivalent material cost and transport expense per unit of biogas: 0.283 RMB ¥/m³

Equivalent material cost and transport expense per unit of electricity: 0.157 RMB ¥/kWh

(3) Personnel Salary \( (E_3) \)

According to the needs of the technological process adopted by the Project, 15 full-time personnel shall be needed for system maintenance and operational management. Totally 270,000 RMB ¥ shall be needed for a full year if each personnel is paid 18,000 RMB ¥ per year.

Personnel Salary for a full year \( (E_3) = 18,000 \times 15 = 270,000 \) RMB ¥

Equivalent personnel salary per unit of biogas: 0.025 RMB ¥/m³

Equivalent personnel salary per unit of electricity: 0.014 RMB ¥/kWh

(4) Overhead expenses \( (E_4) \)

Calculated as 10% of the personnel salary, i.e.:

Full-year overhead expenses \( (E_4) = 270,000 \times 10\% = 27,000 \) RMB ¥

Equivalent overhead expense per unit of biogas: 0.003 RMB ¥/m³

Equivalent overhead expense per unit of electricity: 0.001 RMB ¥/kWh

(5) Depreciation of fixed assets \( (E_5) \)

Assuming a 20-year life cycle for civil buildings and technological facilities and a 15-year life cycle for equipment and a salvage rate of 5% for fixed assets, the composite depreciation rate as calculated is 5.65%.

Annual depreciation of fixed assets \( (E_5) = 5095.9 \times 5.65\% = 2,879,184 \) RMB ¥

Equivalent cost of depreciation per unit of biogas: 0.2628 RMB ¥/m³

Equivalent cost of depreciation per unit of electricity: 0.1461 RMB ¥/kWh

(6) Expenditure on inspection and maintenance \( (E_6) \)

Calculated as 1.5% of the direct investment in equipment, i.e.:
Expenditure on inspection and maintenance for a full year \((E_6) = 2779.1 \times 1.5\% = 416,865\text{RMB}\). 
Equivalent expenditure on inspection and maintenance per unit of biogas: 
\(0.0374\text{RMB} / \text{m}^3\)
Equivalent expenditure on inspection and maintenance per unit of electricity: 
\(0.0214\text{RMB} / \text{kWh}\)

(7) Expenditure on operation and maintenance of generator \((E_7)\)
Expenditure on operation and maintenance (lubricant, etc) of 6 Nos. 500kW generators \((E_6)\) shall be \(30 \times 6 = 1,800,000\text{RMB}\). 
Equivalent expenditure on generator operation and maintenance per unit of biogas: \(0.164\text{RMB} / \text{m}^3\)
Equivalent expenditure on generator operation and maintenance per unit of electricity: \(0.091\text{RMB} / \text{kWh}\)

(8) Annual operational cost \((E)\)
Annual operational cost \((E) = E_1 + E_2 + E_3 + E_4 + E_5 + E_6 + E_7 = 8,998,647\text{RMB}\).
Unit operational cost (incl. depreciation) \(T_1\): equivalent operational cost per unit of biogas and electricity are respectively \(0.8215\text{RMB} / \text{m}^3\) and \(0.4567\text{RMB} / \text{kWh}\)
Annual direct operational cost (excl. depreciation) 
\(J = 899.8647 - 287.9184 = 6,119,465\text{RMB}\).
Unit direct operational cost (excl. depreciation) \(T_2\), equivalent operational cost per unit of biogas and electricity are respectively \(0.5587\text{RMB} / \text{m}^3\) and \(0.3106\text{RMB} / \text{kWh}\).

2. Calculation of Income
(1) Calculation of income from power generation
This biogas engineering project shall achieve an annual power generation of 19,710,000kWh, which shall generate an annual power sales income of 11,707,740\text{RMB} at an electricity price of 0.594\text{RMB} / \text{kWh} (i.e. 0.344\text{RMB} / \text{kWh} as the base price of electricity + 0.25\text{RMB} / \text{kWh} as the subsidy for renewable resources). See Table No. 1.

Table No. 1 Calculation of Income from Power Generation
### Calculation of income from organic fertilizer

The Project shall produce 10,376 tons of biogas residue and an annual income of 2,075,200 RMB¥ at a unit income of 200 RMB¥ per ton.

The biogas effluent shall be provided for free as agricultural fertilizer in the short term thus involving no income and may be sold two years later.

#### Calculation of total income

The two incomes as described above shall add up to a total income of 13,782,940 RMB¥. See Table No. 2.

Table No. 2 Calculation of Total Income

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<th>Income from Organic Fertilizer (10,000RMB¥)</th>
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3. Calculation of economic benefits and investment recovery period

Upon completion, the Project shall produce a yearly income of 13,782,940 RMB¥ from the biogas power generation station. With 8,998,647 RMB¥ and 936,921 RMB¥ deducted as the operational cost and tax, a net income of 3,847,372 RMB¥ is expected. Calculated as static investment, the Project investment shall be recovered in 16.42 years.

### V. Operational control of project pollutants

Here briefly described as follows are the measures of pollution control (See the section on engineering analysis for detailed analysis):

Wastewater: The wastewater produced in the production process is the organic fertilizer, i.e. the biogas effluent. The production capacity is 1,332.47 tons per day. As an organic fertilizer, the biogas effluent shall be used in the orchards and farmlands of
Noise: Pumps, blowers and biogas power generator set shall be the key noise sources under the Project and actions of noise reduction shall be taken against such noise sources in accordance with the “Design Code for Noise Reduction and Silencing in Industrial Enterprises” (GBJ87-85). In addition to the selection of low-noise equipment, measures of sound insulation and vibration reduction shall be taken on the blowers to reduce the transmission of sound wave, reasonably designed sound insulation enclosure and sound insulation windows shall be provided for the blowers and the blower house, and silencers shall be installed on the exhaust pipe of the power generator set. Corresponding vibration reduction and sound insulation measures shall be adopted as a part of the layout plan of the plant area.

Waste gas: The waste gas involved in the production process of this Project mainly consists of the waste gas produced by the biogas power generator and the odor from the homogenizing grit chamber, biogas effluent storage tank and collection tank. The collection tank shall be covered to restrain odor emission while the homogenizing grit chamber shall be covered and provided with devices for biological deodorization. Trees and flowers shall be planted all over the plant area to not only for beautification but also for deodorization.

Solid wastes: The main solid waste involved in this Project is the biogas residue. Through solid-liquid separation of the effluent from the anaerobic fermentation process, the biogas residue shall have a moisture content of 65% or less. The separated biogas residue shall then be conveyed to the drying room to be dried with the remaining heat of the power generator to a moisture content of 25% or less before the biogas residue is packed for sale as fertilizers. The Project shall produce 28.43 tons of biogas residue each day (No drying equipment and process are described for this Project). The sand grits and small amount of excrement settled in the homogenizing
grit chamber shall be collected and transported to the non-hazardous garbage treatment plant of Penglai City for disposal and treatment.

Electromagnetic radiation: The output power line of the Project is identical to the input power line of the original project. Located far from the villages and adopting a transmission voltage of 10KV, the power line of the Project produces no impact of electromagnetic radiation on the local residents.

**Existing pollutions and key environmental problems relevant to the Project:**

The Project Site is a reserve site of Minhe and has not been put into use, thus involving no existing pollutions.
Overview of the Natural and Social Environment of the Project Site

Overview of natural environment (Terrain, topography, geology, climate, meteorology, hydrology, vegetation, etc.):

1. Geographical location

Penglai is located 120°35′ to 121°08′ east longitude and 37°25′ to 37°50′ north latitude on the northern end of Shandong Peninsula. Neighboring on Longkou and Qixia on the west and south and borders on Fushan District on the east, Penglai looks on Changdao Island across the Bohai Sea and the Yellow Sea to the north and faces Liaodong Peninsula to form the Bohai Strait and enjoys a maximum land span of 50.52 km from east to west.

The Project Site is located on the western outskirts of Penglai City. See Figure No. 1 for the specific location of the Project Site.

2. Terrain and topography

Located in the Jiaodong upheaval zone and the low hill area on the north wing of Qixia anticlinorium, Penglai enjoys a combination of three types of landforms, i.e. mountains, highlands and plains, including 65,332 mu of mountainous area, 380,548 mu of highlands and 6,820 mu of plains respectively accounting for 48.29%, 31.36% and 20.35% of the total land area.

The project area is located on a slope terrain that inclines from southeast to northwest and the main stratum exposed in the project area is the ancient metamorphic rock stratum. Enjoying a dry and flat site on an elevated dry land, the Project Site enjoys excellent drainage; since faultage and landslide are rarely seen in the geological structure, the project area is an area of extremely low seismic frequency and intensity.

3. Geology

Located on the north wing of Qixia anticlinorium in Jiaodong upheaval area, Penglai enjoys abundant ground water resources with a water table of 1.5m to satisfy the water consumption in the Project Site, which has no hazardous pollutants and adverse kinetic factors in the proximity and enjoys excellent geological condition.

4. Hydrology
Penglai mainly relies on natural precipitation for supply of water in the urban area. The perennial gross amount of water resources in the urban area is 224.7 million m$^3$, including 188.2 million m$^3$ for perennial average amount of surface water resources and 110 million m$^3$ for perennial average amount of ground water resources. There is only one self-built reservoir and no rivers flowing through the project area.

(1) Surface water

Rivers: Most of the rivers in the project area are seasonable rivers of short distance from the riverhead and rapid streams flowing south to north into the Bohai Sea and the Yellow Sea. There are 92 rivers with a length of 3km or more and 10 of them enjoy a drainage area of more than 30km$^2$, namely, the East Branch of Huangshui River, Pingchang River, Longshan River, Pingshan River, Weiyang River, Wangzhuang River, Fangli River, Yujiazhuang River, Wushilipu River and Fuqing River.

Reservoirs & Dikes: There are 3 medium-sized reservoirs, 9 Type 1 small reservoirs and 130 Type 2 small reservoirs and 338 dikes within the boundary of Penglai City, enjoying a net damming area of 411.2km$^2$, a total reservoir capacity of 146,045,500m$^3$, a total beneficial reservoir capacity of 84,530,000m$^3$ and an effective irrigation area of 137,850mu. Among the large reservoirs are Zhanshan Reservoir, Qiushan Reservoir and Pingshan Reservoir.

(2) Ground Water

Atmospheric precipitation is the only source of supplement to ground water in Penglai and, thus, the water table generally rises and falls with the high flow and low flow periods. Most of the urban area has a 3-4m depth of groundwater table except Beigou area which has a depth of groundwater table of 15m or more and some individual areas where the depth of groundwater table is only around 1m. The highest water level in a year appears in August while the lowest water level generally in June.

5. Climate and Meteorology

Penglai belongs to the subhumid continental climate of East Asia monsoon zone in the north temperate zone and has a continentality of 54.6%. Enjoying moderate temperature with steady changes and relatively small annual and diurnal amplitudes of air temperature, Penglai has an annual average temperature of 12.7 and extreme
highest and lowest temperatures of respectively 38.4 and -14.9.

Penglai has an annual average precipitation of 606.2mm and the maximum annual precipitation of 1122.2mm and the minimum annual precipitation of 307.6mm. The maximum rainstorm precipitation reaches 208.1mm and the average number of days of precipitation is 81.3 days. The maximum number of days with continuous rainfall is 9 days while the maximum number of days without rainfall on a continuous basis reaches 42 days.

Having an annual average relative humidity of 65%, Penglai has dry springs and winters with a relative humidity of 60% and humid summers with a relative humidity of 80% or higher. The annual average evaporation in the urban area is 1950.0mm while the extreme maximum annual evaporation and minimum annual evaporation are respectively 2206.2mm and 1433.8mm.

7. Earthquake

According to the “Planning Map of Seismic Intensity in China”, this area has a seismic basic intensity of 7 degrees.

Overview of Social Environment (Social and economic structures, education, culture, protection of cultural relics, etc.)

I. Overview of Social Environment

Located on the northern end of Jiaodong Peninsula on the coast of the Bohai Sea and the Yellow Sea, Penglai has a total land area of 1,128.6 km² and a total population of 445,000 and administers 7 townships, 5 sub-districts, 1 provincial development zone and 1 provincial tourist resort. Ranking No. 40 among the Top 100 developed counties in China, Penglai has been successively honored as one of China's “Best Tourist City Destinations”, “Advanced Cities in Science and Technology Development”, “Model Cities in Popular Science”, “Advanced Cities in Cultural Development”, “Top Food Industry Cities”, “Advanced Cities in Promoting Chinese Traditional Medicine in Rural Area”, “Advanced Cities in Rehabilitation of Disabled Persons”, Model Cities in Comprehensive Control of Public Security, Garden Cities, Best Cities for Human Settlement and cities with excellent performance in construction of civilized and safe cities, safe production, foreign trade and economy, promotion of rural income, agriculture industrialization, substantial implementation of 9-year compulsory education and substantial elimination of illiteracy among young and middle-aged people, family
planning and the campaign of mutual support between the military and the civilians.

A City of Long History and Beautiful Scenery. Penglai, a famous coastal historical and cultural city with beautiful scenery and tourist attractions, boasts of profound cultural deposits and numerous cultural relics, including Penglai Pavilion, one of the four ancient Chinese pavilions known worldwide, Penglai Water City, the most well-preserved naval base of ancient China, the Praising Temple and Qi Family Paifang to honor Qi Jiguang the national hero and other national key cultural and historical sites under protection. In addition, Penglai is known as the “fairyland in the world” for the marvelous spectacle of “mirage” and beautiful legend of “the Eight Immortals Crossing the Sea” and is included in the list of national level scenic and tourist attractions receiving more than 2.6 million tourists from both home and abroad.

A City of Abundant Products and Prolific Resources. Penglai is one of China’s key places of origin of quality wine grapes and Red Fuji apples and famous for grape farming and wine production. With a planted area of 80,000mu, Penglai enjoys a wine productivity of 80,000 tons, accounting for 1/5 of the total domestic output of wine. As the national leader in dry wine production, Penglai has become one of the Top 10 agricultural industry clusters and one of 7 biggest wine coasts in the world. Relatively developed in see product breeding, Penglai has 5,000 mu of shallow sea aquatic plants and 12,000 mu of abalone and sea cucumber aquatic plants and is China’s largest scophthalmus maximus breeding and production base. With prolific mineral resources, Penglai has more than 20 types of known and explored mineral resources and vast and huge reserves of high quality gold and lime stone, respectively enjoying a total reserve and yearly output of 200 million tons and 160,000 liang, and is China’s third largest city producer of gold. Penglai 19-3 integral oil field discovered 39 sea miles north of Penglai enjoys a reserve of more than 600 million tons and huge potential of exploration.

A City of Advantageous Geographical Position and Convenient Transportation. There are 4 ports within the jurisdiction of Penglai, among which both New Penglai Port and Luanjiakou Port are Class 1 national open ports. Penglai has 3
berths of 50,000 tonnage and 6 berths of 10,000 tonnage and has opened the RO/RO passenger and cargo shipping line to Lvshun and Dalian. Enjoying an annual port capacity of more than 10,000,000 tons, Penglai has become the shortest “Gold Waterway” connecting East China and the northeastern provinces of China. Penglai has 4 high standard national or provincial highways, including Expressway No. 206, running through and is 70km from Yantai Airport and railway station to the east and 200km from Qingdao Airport and Qingdao Port to the south. Shandong Airlines has located one of its airports in Penglai and the Dezhou-Longkou-Yantai Railway under construction is going to cross Penglai, setting up a transportation network comprising of sea, air and land transportation.

**A City of Booming Economy and Prosperous Society.** Devoted to building itself into the “regional economic center”, Penglai has been sparing no efforts to “expand its gross product and achieve a leap forward in economic growth by capturing the precious opportunities and drawing on the external forces” for significant development of its economy and public undertaking. In 2005, Penglai accomplished a total output value of 17 billion RMB ￥, a local fiscal revenue of 700 million RMB ￥ and a total retail sales of consumer goods of 3.7 billion RMB ￥. Focusing its efforts in the development of four unique leading industries including portside industry, tourism industry, grapes and wine and automotive and components, Penglai attract more than 30 Chinese listed companies and large enterprises including State Grid Power Generation, North Benz, Jutao Marine Engineering Heavy Industry, Guangyuanfa Petrochemical, Xinqinglu Sheet Steel, COFCO Great Wall, Suntime International and Qingdao Beer and more than 100 overseas companies including Philippines Continental Cement, Taiwan Sinyih Ceramic and France Bordeaux. Penglai invested more than 30 billion RMB ￥ to secure its position as the regional tourist center and famous Chinese wine town and is growing into an important port city and portside manufacturing base in Shandong Peninsula. Penglai invested more than 8 billion RMB ￥ to improve its tourist, human settlement, commercial and trade, cultural and sport, environmental protection and infrastructure facilities aiming to set up its city identity as the “fairyland in the world” and
“international peace city”.

II. Key environmentally sensitive spots around the proposed Project

The Project is sited on a plot in the breeding base preserved by Shandong Minhe Animal Husbandry Co., Ltd. for expansion and has only broiler chicken farms, breeder farms and chickling hatchery and no industrial and mineral enterprises on the periphery.

In the area of scores of kilometers around the Project Site are mainly fruit trees such as vines and apple trees and crops such as corn and peanuts and the closest village is Hanwang Village 800m east of the Project Site.

See Table No. 3 for an overview of the villages around the proposed Project.

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Village</th>
<th>Direction</th>
<th>Distance</th>
<th>Population</th>
<th>Area of Farmland (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wujiacun</td>
<td>South</td>
<td>1.4km</td>
<td>310</td>
<td>90.67</td>
</tr>
<tr>
<td>2</td>
<td>Lvfengcun</td>
<td>Northwest</td>
<td>1.5</td>
<td>410</td>
<td>60.58</td>
</tr>
<tr>
<td>3</td>
<td>Qugoucun</td>
<td>North</td>
<td>1.6</td>
<td>220</td>
<td>43.93</td>
</tr>
<tr>
<td>4</td>
<td>Houhancun</td>
<td>North</td>
<td>1.4</td>
<td>270</td>
<td>27.72</td>
</tr>
<tr>
<td>5</td>
<td>Hanwangcun</td>
<td>East</td>
<td>0.8</td>
<td>745</td>
<td>154.48</td>
</tr>
<tr>
<td>6</td>
<td>Minhe Well 1</td>
<td>South</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Minhe Well 2</td>
<td>North</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Qujiagou well</td>
<td>North west</td>
<td>1.5 km from the land of using methane liquid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Wujiagou well</td>
<td>South</td>
<td>1.0 km from the land of using methane liquid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Investigation reveals that there are no mineral reserves, forests, wild life and other national reserves around the Project Site.

The Project Site is located on the southern outskirt of Penglai and no natural reserves, scenic and tourist attractions, scenic spots and historical sites and important political and cultural facilities in an area of 20 km from the Project Site.
III. Overall City Planning

Scope of the Planning Area --- The scope of the planning area as determined is the administrative districts of Penglai City including 5 subdistricts and 7 towns with a total area of 1,123.11km\(^2\). Planning period: 2005 to 2010 for the short term and 2011 to 2020 for the long term and 2020 to 2050 for the long range.

Nature of city --- a tourist city known for its coastal scenery like the fairyland in the world.

City functions --- (1) Political, economic and cultural center of Penglai; (2) an important satellite city on the west wing of Yantai; (3) an important tourist base on Jiaodong Peninsula; (4) a large and medium-sized port base within the municipal territory of Yantai; (5) a food processing and brewage base mainly relying on the grape industry.

Objectives of economic growth --- A GDP of 25 billion RMB ¥ and 65 billion RMB ¥ respectively by 2010 and 2020 and a GDP per capita of 6,000 US$ and 12,000 US$ respectively by 2010 and 2020.

Population and urbanization --- The total population of Penglai will reach 510,000 and 650,000 respectively by 2010 and 2020 and the urban population and level of urbanization will get to 300,000 and 60% and 480,000 and 75% respectively in 2010 and 2020.

Spatial layout of the urban area and towns --- “Polarization of the central city, optimization of Beigou Block and incubation of Daxingdian Block”. The central city shall be expanded and further developed into an integrated center with strong centralization and radiation functions that can truly function as a portal city to interact with Japan and Korea and become a base of portside industries.

Spatial layout of towns --- An industrial spatial layout comprising of “one city plus two blocks and one belt, two axes and three zones” shall be created for the entire city. “One city” refers to the central city while “two blocks” refer to Beigou Block and Daxingdian Block; “One belt” refers to the coastal industrial development belt along
National Highway No. 206, “two axes” refers to the south-north tourist and sightseeing axis along the ecological valley and the east-west town development axis along Wei-Wu Expressway, and “three zones” refer to the town development zone in the north, the agricultural development zone in the middle and the ecological forest protection area in the south.

Road traffic --- a #shaped fast-speed traffic network shall be formed within the municipal territory to effectively connect the adjacent cities. The network shall include National Highway No. 206 and 302 horizontally and the provincial highways of Lianzhai Highway and Lianfeng Highway. The Penglai Section of Huang – Yan Railway (from Huanghua Port to Yantai) shall be constructed and 3 railway stations shall be placed in the territory of Penglai, respectively Beigou Freight Station, Nanwang Intermediate Station and Chaoshui Freight Station. Railway sidings shall be provided for the New Port and Luanjiakou Port. Penglai New Port shall be constructed as a key project into a medium-sized port in Yantai City for the long run while Luanjiakou Port shall be constructed into a modern port integrating the functions of oil shipping, fishing and cargo handling terminals. It is recommended to relocate the airport to Chaoshui Town.

Development goals of inhabitance --- It is planned that the living space per capita shall reach 30m2 and 35m2 respectively by 2010 and 2020 and every household may own a residence with beautiful environment, complete supporting facilities and full functions.

Development directions of the urban land --- An overall development concept of “expanding to the east and west, optimizing the middle and controlling the south and north” shall be followed in the city development on the basis of the status quo of land use. The city shall mainly expand towards the east and extend to the west to an appropriate extent to highlight the elements of “mountain, sea, pavilion and city” in a zonal urban layout.

Planning of land for administrative and office buildings --- The plots along Nanguan Road shall be gradually reconstructed to a centralized accommodation for administrative
and office buildings. The area west of the old city and east of Xiaotaishan shall be planned as the new administrative center to led the development of the plots on the west side of the urban area, spread out the population and alleviate the pressure on the old city.

Land for commercial and banking industries --- The planning requires that land for commercial and banking industries shall be arranged at the city and district levels. City level commercial center: The importance of the traditional trade center in the old urban area shall be further reinforced to highlight its commercial, service, tourist and entertainment functions. District level commercial center: Comprehensive service areas shall be constructed as supportive facilities for the residents as a part of the urban functional zoning and shopping, home appliance, catering and other commercial services shall be provided in the central sections of the various zones to provide services for residents in the zone. 3 district level commercial centers shall be planned.

Land for cultural and entertainment facilities --- According to the planning, the cultural and entertainment facilities, including science museums, libraries, exhibition centers and large symbolic cultural facilities, and land for news and publishing and broadcasting and TV facilities shall be arranged in a centralized way at Xiaotaishan Administrative and Cultural Center to create a new city-wide cultural center. Areas adjacent to the coastal sightseeing and tourist zone shall be planned for cultural and entertainment facilities serving the tourists; small theme museums and exhibition halls shall be constructed relying on supports from organizations of cultural relics protection as a part of tourism projects to promote the cultural quality of the city. Existing cultural and entertainment facilities shall be preserved to the best possibility in the reconstruction of the old city and one comprehensive cultural center including libraries, cinemas and youth and teenager activity centers, shall be constructed as a mandatory requirement in each block. More efforts shall be made in the construction of neighborhood and community cultural facilities and improvement to small cultural activity centers, libraries, game halls.

Land for sport facilities --- A network of sport facilities at the city, block and
community levels shall be planned and improved. A city-level sport center shall be constructed in association with the administrative center between Nanguan Road and Zhonglouxi Road west of Gangnan Road and various sport venues shall be built. Two block-level sport parks and sport venues shall be constructed in the plot east of Dengzhou Road, north of National Highway No. 206, west of Pingshan River, east of Shahexi Road to serve the urban residents.

Land for medical and health facilities --- The functions of the medical establishments at all levels shall be defined in a reasonable way so as to optimize the configuration of health resources and realize the socialization of health resources. By 2020, the number of sickbeds per 1000 thousand persons shall reach 8 while the coverage of the community health service shall reach 100%. Private clinics shall be developed to an appropriate extent as a supplement to the public medical and health system.

Land for education and scientific research --- a plot for education and scientific research is planned in the area west of Gangnan Road in association with the construction of the cultural and sport center for development of higher education and adult education.

Located in Beigou Block in Penglai City, this Project shall optimize the environmental quality of this area and conform to the overall development plan of Penglai City.
Environmental Quality Status
Environmental quality status and key environmental problems (ambient air, surface water, ground water, sound environment and ecological environment, etc.) of the area of the Construction Project:

The environmental quality of the Project Area is assessed in accordance with the 2005 Environmental Quality Report for Penglai.

I. Status quo of environmental quality

1. Quality of surface water and near-shore water

All the indices other than total nitrogen of the surface water head sites in Penglai conform to the quality standard for potable surface water while all the indices for ground water head sites conform to the quality standard for potable ground water; the urban ground water fully conforms to the “Quality Standard for Ground Water” and the key rivers satisfy the requirements of the functional zones they belong to; the water quality in the near-shore water satisfies 100% of the requirements of the respective functional zones.

Penglai has centralized potable water heads for both surface and ground water, including four surface water intake points respectively located in the middle and outlet of Zhanshan Reservoir and Pingshan Reservoir and one ground water intake point at Penglai Water Supply Company. 53.4% of the total water supply for the city comes from the ground water head at Chunyu. In 2005, Pingshan Reservoir and Zhanshan Reservoir supplied 105.9 tons and 209.26 tons of water respectively, 97.90% and 98.40% of which conformed to the water quality standard.

The dry-up rate at the monitored river sections reaches 21.2%. Among the monitored sections, the section of Longshan River at the outlet of Zhanshan Reservoir and the section of Huangshui River at Wolong conform to Class II water quality, accounting for 22.2% of all the monitored sections while the other monitored sections conform to Class III water quality standard. Among the four rivers, the Penglai section of Huangshui River meets Class II water quality standard while the other rivers conform to Class III water quality standard.

Neighboring the Bohai Sea and the Yellow Sea, Penglai has excellent Class III near-shore water where petroleum (0.12) is the key pollutant. Among the 10 monitored points in the sea area of Penglai, 80% are Class I and 20% are Class III. The near-shore water conforms to 100% of the requirements of the respective functional zones.

The Company has a self-built reservoir in this area with a storage capacity of
17,000m³ and relying on natural precipitation for supplement. This reservoir is mainly used for irrigation of the adjacent farmland and floor washing in the breeding farm. See Table No. 4 for the water quality test results.

Table No. 4: Water quality test results for the reservoir over the past three years

<table>
<thead>
<tr>
<th></th>
<th>mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>7.10</td>
</tr>
<tr>
<td>NO₂-N</td>
<td>0.205</td>
</tr>
<tr>
<td>NO₃-N</td>
<td>21.8</td>
</tr>
<tr>
<td>NH₃-N</td>
<td>0.12</td>
</tr>
<tr>
<td>Non-ionic ammonia</td>
<td>0.002</td>
</tr>
<tr>
<td>CODer</td>
<td>4.51</td>
</tr>
<tr>
<td>Volatile phenol</td>
<td>Not detected</td>
</tr>
<tr>
<td>Hex chrome</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

It is seen in Table No. 4 that this reservoir has high content of NO₃-N as a result of the chemical nitrogen fertilizer washed into the reservoir in rain season from the vast area of farmland in the neighborhood.

2. Ground water

The ground water in the assessed area flows from south to north and there are two wells (positions of which are shown in the attached figure) and one small reservoir (as alternate water source) in the Project Site. The wells are less than 100m deep and 1,980m³ of water is extracted each day mainly for domestic use and as drinking water for chickens on the chicken farm. Here indicated as follows are the monitoring results of ground water over the past three years:

Table No. 5  Ground Water Monitoring Results of the Past Three Years

<table>
<thead>
<tr>
<th>Monitored Item</th>
<th>Unit: mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>7.32</td>
</tr>
<tr>
<td>Total Hardness</td>
<td>218</td>
</tr>
<tr>
<td>Chloride</td>
<td>122</td>
</tr>
<tr>
<td>Ammonia Nitrogen</td>
<td>Undetected</td>
</tr>
<tr>
<td>Potassium permanganate index</td>
<td>1.9</td>
</tr>
</tbody>
</table>

It is obvious in Table No. 5 that the deep phreatic water in the assessed area satisfies Class II standard specified in the “Quality Standard for Ground Water” (GB/T14848-93). This Project involves a level of water consumption as low as 12.5m³ per day mainly for domestic use and cooling of the generator set. Water needed for this Project is fully supplied by the two 100m deep water wells located in the existing breeding farm. These wells have large supply capacity and are able to satisfy the need of the Project, thus making it unnecessary to construct new wells. According to the data provided by the manufacturer for the past three years, these wells produce water of excellent quality conforming to the quality standard for both domestic and production water. The yearly water need for Penglai is 60,000,000 to
80,000,000m³, 70% of which are ground water. Since the water consumption by this Plant only accounts for a very small part of the total water consumption of the whole city, no impact shall be produced on the ground water by the construction of the Project. There are two wells around the Plant, both located in the villages supplying drinking water for the villagers. Since these wells are far from the fields, no ground water pollution shall happen through proper control of and scientific and reasonable application of biogas effluent and residues.

3. Ambient Air

In 2005, Penglai witnessed a substantially stable quality of the air environment and excellent ambient air quality in the urban area. 100% of the urban air quality monitoring came out with excellent results. All the three air quality indices of sulfur dioxide, nitrogen dioxide and inhalable particulate matters meet Class I standard of GB3095-1996 Ambient Air Quality Standard, with inhalable particulate matters as the primary pollutant.

The annual average daily SO₂ is 0.017mg/m³, complying with Class 1 national standard. The annual average daily of SO₂ ranges from 0.001 to 0.098mg/m³ while the monthly average ranges from 0.004 to 0.038mg/m³, with those for January and February exceeding Class 1 standard.

The annual average daily NO₂ is 0.020mg/m³, complying with Class 1 national standard. The annual average daily of NO₂ ranges from 0.004 to 0.105mg/m³ while the monthly average ranges from 0.013 to 0.036mg/m³, not exceeding Class 1 national standard.

The annual average daily of inhalable particulate matters is 0.036mg/m³, complying with Class 1 national standard. The annual average daily of inhalable particulate matters ranges from 0.012 to 0.175mg/m³ while the monthly average ranges from 0.030 to 0.042mg/m³, not exceeding Class 2 national standard.

The annual average concentrations of SO₂, NO₂ and TSP of the past three years contained in the ambient air of the assessed area are respectively 0.027mg/l, 0.024mg/l and 0.118mg/l, satisfying Class II standard specified in GB3095-1996 Ambient Air Quality Standard.
Table 6 Monitoring Results of Ambient Air Quality over the Past Three Years

<table>
<thead>
<tr>
<th>Measured Value</th>
<th>Standard Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>0.027</td>
</tr>
<tr>
<td>NO₂</td>
<td>0.024</td>
</tr>
<tr>
<td>TSP</td>
<td>0.118</td>
</tr>
</tbody>
</table>

Monitoring points were arranged at the windward and leeward of the plant boundary on August 5, 2007 to monitor the content of ammonia and Hydrogen sulfide in the air, both of which were found meeting Class 1 standard for plant boundary specified in the “Emission Standard for Odor Pollutants” (GB14554-93).

Table No. 7 Monitoring results of ammonia and sulfureted hydrogen

<table>
<thead>
<tr>
<th>Measured Value</th>
<th>Standard Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>0.10</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>0.01</td>
</tr>
<tr>
<td>Ammonia</td>
<td>1.5</td>
</tr>
<tr>
<td>Hydrogen sulfide</td>
<td>0.06</td>
</tr>
</tbody>
</table>

4. Ambient Noise

Penglai had an excellent sound environment in 2005, with the regional noise, the road traffic noise and the functional zone noise conforming to the national standard. The average noise level of road traffic is 67.1dB while the average value of regional ambient noise is 53.8dB and 39.9dB respectively at day time and night time, conforming to the requirements of the functional zoning standard. The noise level of various functional zones meets the national standard at a rate of 100%.

Since the Project Site is close to the farmland, the noise level conforms to the requirements for Class 2 area specified in the “Standard of environmental noise of urban area” (GB3096-1993).

5. Ecological environment

Project Site used to be an unoccupied plot in the plant area and involves no environmental problems arising from industrial pollution. In addition, as a result of the long-term presence of human beings, there are neither regional plant communities...
in the project area except for an extremely small quantity of herbs nor endangered species. There are insects such as crickets, reptiles such as lizards and small mammals such as field mouse, but extremely small in quantity.

**Key objectives of environmental protection (incl. list and level of protection):**

The key objectives of protection for ambient air shall be Hanwangcun Village, Houhancun Village and Wujiacun Village adjacent to the project site and the requirements specified for Class II area in the “Ambient Air Quality Standard” (GB3095-1996) shall be executed;

The reservoir constructed by the Company is the key objective of protection for surface water and the standards specified Class V waters in the “Environmental quality standard for surface water” (GB3838-2002) shall be executed; The ground water in the area around the villages is the key objective of protection for ground water and the standards specified Class III in the “Quality standard for ground water” (GB/T14848-93) shall be executed.
**Applicable Standards for EIA**

| Pollutant emission standard | “Integrated emission standard for air pollutants” (GB16297-1996), Table 2, Class II (This standard shall be executed for emission control of biogas power generator set since the national authority has not published any industrial emission standard concerning biogas power generator set); (GB14554-93) “Emission standard for odor pollutants” Class II; “Standard for bio-organic fertilizers” (NY884-2004); (GB7959-87) “Sanitary standard for the non-hazardous treatment of might soil”; (GB18596-2001) “Discharge standard of pollutants for livestock and poultry breeding”; (GB12348—90) “Standard of noise at boundary of industrial enterprises” Class II; (GB12523-90) “Noise limits for construction sites” for the construction period. |
| Total Control Indices | Here described as follows are the calculated emission limits of pollutants subject to total control in the Project and may be used for reference of the total control indices for the local area: SO₂: 6.3t/a |
Engineering Analysis of the Construction Project

Overview of the Technological Process (Diagram):

1. Construction Phase

   Construction Phase
   
   Clearing & Grubbing  Stone & Earthwork  Groundwork  Main Works  Wrap-up
   
   Dust  Dust  Dust  Solid Waste  Solid Waste  Dust  Solid Waste

2. Operation Phase

   The technological line of this biogas project is shown in Figure 1: Biogas Engineering Technological Process of Shandong Minhe Broiler Chicken Breeding Base, Engineering Analysis Section of the Special Environmental Impact Assessment.

Key pollutant-producing processes:

I. Construction Phase

   1. Air

      The key sources of pollution during the construction phase shall include dust raised in the processes of clearing and grubbing, groundwork excavation and land leveling, tail gas and dust produced in the process of equipment operation and vehicle transportation and exhaust gas discharged from boilers for living activities on the construction site.

   2. Noise

      Noise produced during the operation of construction plants and vehicles during the construction phase (for stone and earthwork, piling, structures and decoration, etc);

   3. Wastewater

      Domestic wastewater produced by the construction workers and various construction wastewater arising from the construction activities during the construction phase;

   4. Solid Wastes
Waste bricks, rocks, washing debris, packing boxes and bags of various construction materials and domestic garbage and construction debris produced from resettlement and demolition and decoration activities on the construction site during the construction phase.

II. Operation Phase

1. Exhaust Gas

The exhaust gas involved in the project mainly include odor generated from the pretreatment process and smoke discharged by the biogas power generator set.

2. Wastewater

The wastewater produced by this Project mainly includes the biogas effluent, which is used as the material for production of organic fertilizer while the domestic wastewater is mainly from the offices and toilets.

3. Noise

Noises involved in this Project mainly come from the pumps, blowers and the cooling tower and heat exchangers of the biogas power generator set.

4. Solid wastes

Biogas residue, which is a semi-finished organic fertilizer, shall be the main solid waste produced by the Project and may be sold as quality fertilizers; the domestic garbage shall be transported in semi-closed trucks by the municipal and environmental sanitation departments for centralized treatment; sediments produced in the homogenizing grit chamber and other pretreatment processes and the small amount of excrement residues shall be transported to the refuse treatment plant of Penglai for disposal and non-hazardous treatment.

5. Electromagnetic radiation

Same as the input power line of the existing project, the 10KV output power line of the Project mainly runs through mountains and farmlands and is kept far from villages and shall not produce any impact on the residents.
## Generation and Predicted Emission of Key Pollutants under the Project

<table>
<thead>
<tr>
<th>Contents</th>
<th>Source of pollution (Serial Number)</th>
<th>Name of Pollutant</th>
<th>Concentration &amp; volume of pollutants prior to treatment (Measuring Unit)</th>
<th>Concentration and volume of discharged pollutants (Measuring Unit)</th>
</tr>
</thead>
</table>
| **Air pollutants** | Biogas power generator set | SO₂  
NOₓ | 53.5mg/m³, 6.3t/a  
50.1mg/ m³, 5.9t/a | 53.5mg/ m³, 6.3t/a  
50.1mg/ m³, 5.9t/a |
| | Homogenizing grit chamber  
Pretreatment process  
Biogas effluent storage tank | Odor | Biological odor control device  
Covering, enclosing and landscaping separation and other actions | ≤20（No dimension） |
| **Water Pollutants** | Production | Biogas effluent | 1343.72 t/d（490,000t/a）  
TS 1.6% | Reused as organic fertilizer |
| | Domestic | CODcr  
NH₃-N | ≤300mg/L; 39kg/a  
≤25mg/L; 3.2kg/a | Reused after treated in the Project |
| **Solid Wastes** | Production | Biogas residue | 60.91 t/d  
(22232.2t/a)  
TS 35% | Sold as organic fertilizer after Phase 2 dewatering  
TS 75%  28.43t/d（10376t/a） |
| | Homogenizing grit chamber  
Sediments and small amount of excrement residues | | | Transported for non-hazardous disposal and treatment |
| | Employees | Domestic wastes | 2.8t/a | Cleared and removed by environmental sanitation department |

**Key noise-producing equipment shall include pumps, blowers and the cooling towers and heat exchangers for the biogas power generator set while the noise level at the noise sources ranges from 75dB(A) to 90dB(A).** Actions shall be taken to reduce the vibration level of the wastewater and sludge pumps, the blowers and the cooling towers and other equipment; silencers shall be installed at the exhaust pipe of the power generator set; quality construction materials of sound insulation shall be used and sound insulation windows and doors shall be provided in the additionally built pump houses and generator houses; sound absorption materials shall be applied on the roof and side walls of the workshops to reduce the environmental impacts. It is predicted that the Project, up completion, shall comply with Class II indices specified in (GB12348-90) “Standard of noise at boundary of industrial enterprises”, i.e. ≤60dB(A) for daytime and ≤50dB(A) for night time.
Same as the input power line of the existing project, the 10KV output power line of the Project mainly runs through mountains and farmlands and is kept far from villages and shall not produce any impact on the residents.

**Key environmental impacts:**

Mechanical noise generated and dust raised by vehicles and rolling and compacting operations during the construction of the Project may bring impacts to the surrounding environment to a certain extent, which, however, are relatively slight since the construction activities are conducted within the boundary of the plant and involve a small coverage and short construction period. In addition, the surrounding environment is expected to recover in a relatively short time after the Project is completed since there are no sensitive objectives and species subject to environmental protection in the areas around the Project Site. Stronger efforts are to be made in the landscaping of the plant area during the construction of the Project to build a plant environment that is beautiful, clean and with benign environmental cycle. To sum up, this Project produces relatively slight impacts on the local environment.
**Environmental Impact Analysis**

**Brief analysis on environmental impacts in the construction phase:**

The key impacts on the environment during the construction phase of the Project are reflected in the dusts, noises from construction plants and solid wastes produced by the construction activities.

Foundation excavation, land leveling and other activities during the construction phase may result in exposure of earth and stockpiling of construction materials that will raise dust in dry and windy weathers. As a result, the amount of suspended matters in the air shall increase, resulting in the pollution of the local air environment.

Noise mainly comes from the excavators, concrete mixers, vehicles and other construction plants and the process of transportation of such construction plants. The noise level of the aforementioned plants ranges from 80 to 100dB(A) and local impacts to a certain extent shall be generated on the construction site.

Construction waste and domestic waste are the main solid wastes discharged in the construction phase. Failure in proper stockpiling and control of such wastes may result in the displacement of such wastes into the ambient air or surface water and further environmental impacts through permeation into the ground water.

An analysis of the construction scope reveals that the impacts on the ambient environment caused by dust and mechanical noise during the construction phase shall be short duration since the Project has a relatively small construction scope and short construction period and it is likely to alleviate the pollution by taking appropriate actions including:

The solid wastes of all varieties produced in the construction phase shall be removed in a timely manner and unorganized discharge is prohibited. Water spraying of appropriate level shall be conducted on a regular basis on the surface of the earth stockpiles to prevent dusting in windy weathers and the earth stockpiles shall be fenced up and protected to prevent possible scouring in rainy days and pollution to the surrounding environment. Vehicles transporting materials or wastes shall be properly covered to prevent dusting and spillage of materials in the course of transportation.

Construction plants of low noise level shall be used and the construction activities shall be carried out in accordance with the requirements of the noise prevention regulations established by the local environmental protection authority to alleviate the impacts produced by the noise on the surrounding environment and the
normal life of the villagers in the neighborhood.

Wastewater produced from the construction process shall be received by the existing wastewater treatment facilities to avoid uncontrolled discharge.

All domestic wastes shall be stored in rainproof dustbins (purchased in advance) and removed together with the construction wastes by the municipal environmental sanitation department so as to eliminate the environmental impacts from the discharge of solid wastes; earth excavation in the plant area shall be excavated and backfilled in layers as scheduled, with the surface layer backfilled with the surface soil to the best possibility.

Analysis on environmental impacts during the operation phase:

(I) Analysis on the environmental impacts of pollutants generated by the Project

1. Analysis on the environmental impacts on the ambient air

The power generator involved in the Project shall be fueled with biogas and emits a very small volume of pollutants, which comply with the environmental standards; odor generated from the excrement & sewage pretreatment process shall comply with the discharge standard after treated with the biological odor control device. Landscaping belts shall be provided and trees shall be planted to absorb odor and separate the key sources of pollution; since the Project Site is located in a relatively spatial environment and no sensitive objectives are present in the short distance, pollutants generated from the exhaust gas produce very little environmental impacts.

In order to prevent possible environmental pollution arising from the spillage and leakage of materials in the course of transportation, all the vehicles shall be fully-enclosed tank trucks. In addition, corresponding management regulations shall be established and the transportation personnel shall be trained to promote their awareness of safety and environmental protection; plans shall be established and facilities shall be provided for emergency response to accidents so that actions are taken to deal with any leakages.

2. Analysis on the environmental impacts on surface water

This Project is constructed to improve the environmental quality of the breeding farm and the waters and eradicate the environmental pollution problems relevant to the excrement & sewage discharged by the enterprise.
The Project shall treat 1,000m³ of washing wastewater and 500 tons of chicken excrement produced by the breeding farm on a daily basis. The Company uses 8 types of chicken feedstuff that fall into two categories, i.e. feedstuff for broiler chicken and feedstuff for breeder. All the feedstuff have stable quality and are produced by the Company with corn, corn oil, corn protein meal, wheat, wheat bran, bean cake, peanut cake, cottonseed cake, fish meal, shell meal, stone chips, stone powder, calcium hydrogen phosphate, salt, sodium bicarbonate and premix. Premix accounts for 1% to 1.5% of the mix design and mainly include complex vitamin, complex microelement, probiotics, methionine, middling, choline chloride and stone powder. 20% of the premix is complex microelements (including 47% for zinc and manganese, 40% for stone powder carrier and 14% for copper, iron and selenium). A very small amount of complex microelements is added based on the breeding need and the majority of the complex microelements are absorbed by the chicken. Only a very tiny proportion of the complex microelements is discharged and no impact shall be produced on the quality of the biogas effluent and residue and no environmental pollution shall be resulted since the metallic microelements are also essential for plants. The dewatered and dried biogas residue can satisfy the “Standard for bio-organic fertilizers” (NY884-2004). No national standard has been published so far regarding the utilization of biogas effluent as organic fertilizer. According to the relevant data, biogas effluent contains a large varieties of bioactive substances, e.g. amino acid, microelements, plant growth substances, Vitamin B and some antibiotics. Butyric acid contained in organic acid and gibberellin, heteroauxing and vitamin B12 contained in phytohormone have obvious inhibitory action on pathogens. Ammonia and ammonium salt and some antibiotics contained in the biogas effluent act directly on the crop diseases and insect pests. Biogas effluent, which is free of pollutants, residual toxicity and drug resistance and can prevent and control plant diseases and insect pests, is also known as “biological pesticide”. Test shows that biogas effluent prevents and controls 23 types of diseases and 14 types of insect pests for 13 types of crops including grain plants, cash crops, vegetables and fruits. In some cases, biogas effluent alone can be as efficient as or even more efficient
than pesticides while in some other cases biogas effluent may, as an additive, reinforce the preventive and control effect of pesticides. Biogas effluent may be used to prevent and control plant diseases by means of seed soaking in such effluent or application of biogas fertilizer as base fertilizer and top dressing and to prevent and control insect pests by means of application of biogas fertilizer and direct application of biogas effluent. Massive application of chemical fertilizer resulted in inadequate organic matters, degraded soil quality in the surrounding farmland and poor quality of the agricultural products and biogas effluent has been widely acknowledged by the farmers in the neighborhood as an organic fertilizer and shall be provided to the farmers free of charge in the early period as of the completion of the Project. Therefore, farmers in Beigou and other towns surrounding the plant area are very willing to apply biogas effluent in their orchards and farmland. A storage tank with a capacity of 50,000m$^3$ shall be constructed under the Project for storage of biogas effluent. In addition, farmers who utilize the biogas effluent shall also construct their own biogas effluent storage tank with a total capacity of more than 120,000m$^3$. These storage facilities shall fully satisfy the need for storage of biogas effluent in non-fertilization seasons and no environmental pollution shall result from discharge of excessive biogas effluent for reasons of inadequate space of storage. A “Technical Manual on Utilization of Biogas Effluent” shall be prepared and provided to the farmers to guide and guarantee the reasonable and scientific application of biogas effluent. Since the wastewater of the breeding farm after treatment is not discharged to the environment and the environmental pollution caused by direct discharge as it is now shall be changed, the local environment shall be improved as well as the quality of the ground water in the adjacent area.

3. Analysis on environmental impacts on ground water

The Project involves a level of water consumption that is as low as 12.5t/day and may be satisfied with the existing well of the chicken farm. Thus no new wells are needed. No impact shall be caused on the ground water due to reverse flow of sea water as a result of the construction of the Project since the existing well has a relatively long distance of approximately 8km from the sea and the additional water demand is low. The key impacts on ground water shall arise from the leakage of the key structures and
pipelines. In order to prevent such pollution, high leakage-proof standard shall be enforced in the design and construction of wastewater collecting and treatment facilities; secondly, stronger efforts in operation control shall be made to ensure regular inspection of the leakage-proof status of the sewage pipelines and structures of the wastewater treatment plants. In addition, the floors of the biogas residue storage yard shall be paved with concrete and cofferdams, drainage ditches and collecting wells shall be provided adjacent to the storage yard to channel the drainage in the course of biogas residue storage to the biogas effluent storage tank and avoid possible impacts on the shallow seated ground water around the plant area during the stockpiling and storage of sludge. A “Technical Manual on Utilization of Biogas Effluent” shall be prepared and provided to the farmers as a guidance on the application and utilization of biogas effluent and residue to make sure the biogas effluent and residue are utilized and applied as needed at fixed and controlled application magnitude and frequency to avoid possible waste and loss of and ensure scientific application of the fertilizer. The maximum application of biogas effluent per mu per year shall be around 10 tons and 49,000 mu farmland shall be needed in total for the digestion of the 490,000 tons of biogas effluent produced each year. There are up to 100,000 mu of farmland available for application of biogas effluent adjacent to the Plant Area and in the surrounding towns. The biogas effluent produced under the Project shall be fully utilized without exceeding the maximum limit. In addition, no problem was noticed based on the utilization of biogas effluent over the recent years. Therefore, no adverse impacts shall be produced on the ground water in the plant area due to leakage of wastewater from the proposed Project if appropriate actions are taken. In addition, since no wastewater is discharged into the environment, the regional ground water environment shall expect improvements.

4. Analysis of impacts on regional sound environment

Operation of pumps, blowers and biogas power generator set shall be the key noise source under the Project and actions of noise reduction shall be taken in accordance with the “Design Code for Noise Reduction and Silencing in Industrial Enterprises” (GBJ87-85). In addition to the selection of low-noise equipment, measures of sound insulation and vibration reduction shall be taken on the blowers to reduce the transmission of sound wave, reasonably designed sound insulation enclosure and sound insulation windows shall be provided for the blowers and the blower house, and
silencers shall be installed on the exhaust pipe of the power generator set. Corresponding vibration reduction and sound insulation measures shall be taken for the work pumps while landscaping and sound absorption measures shall be adopted as a part of the layout plan of the plant area.

With actions taken to reduce vibration and insulating and eliminating noises, the outdoor noise level of the project plants shall be decreased to less than 70dB(A) and the noise level at the boundary of the plant area may satisfy the Class II requirements in “Standard of noise at boundary of industrial enterprises” (GB12348-90) because of range attenuation.

In order to further alleviate the impacts on the surrounding environment by the Project, the following advices may be taken into consideration during the design and construction of the Project:

Use the range attenuation theory of sound to achieve noise reduction: The space between the structures and the sound source may be enlarged in the general plan to alleviate the noise impacts on adjacent structures.

Use sound arresters to achieve noise reduction: Provide sound insulation facilities to the partition walls, doors and windows between the operator’s room and rooms where pumps and motor equipment are installed to reduce the impact of direct sound on human body.

Take further actions of vibration reduction on the equipment to achieve noise reduction: Dampers or flexible connectors may be used in the installation of equipment and connection of equipment and pipeline to reduce vibration.

Achieve noise reduction by means of landscaping.

5. Analysis of environmental impacts of solid wastes

Biogas residue produced in the process of anaerobic biochemical treatment in a daily capacity of 60.91 ton under the Project shall be the main solid waste and, as a semi-finished organic fertilizer, may be sold as quality fertilizers after the moisture content is decreased to below 25% through drying in Phase II. Drainage arising during the process of biogas residue stockpiling shall be discharged to the biogas effluent storage tank to avoid possible impacts on the shallow seated ground water around the Project Site; sediments produced in the homogenizing grit chamber and other pretreatment processes and the small amount of excrement residues shall be transported to the refuse treatment plant of Penglai for disposal and non-hazardous treatment; the
elemental sulfur, a product of biological desulfurization, may be recovered and sold.

Approximately 2.8 tons of domestic garbage shall be produced by staff in the plant area and transported in semi-closed trucks by the municipal and environmental sanitation departments for centralized treatment.

Attention shall be paid to the control of spillage and timely removal of solid wastes during the operation and management of the Project so that the solid wastes are properly treated and no impacts are caused on the surrounding environment.

With the above actions taken, the pollutants discharged upon the completion of the Project shall satisfy the national standard and produce little impact on the ambient environment.

6. Impacts of electromagnetic radiation

The output power line of the Project is identical to the input power line of the original project. Located far from the villages and adopting a transmission voltage of 10KV, the power line of the Project mainly runs over mountainous areas and farmland and produces no impact of electromagnetic radiation on the local residents.

(II) Analysis of environmental hazards of the Project

The key environmental hazards involved in the Project shall be the leakage and explosion of biogas generated from anaerobic digestion process.

Physiochemical property: The biogas is an achromatic, odorous, poisonous gas containing 55% to 70% of CH₄, 28% to 44% of CO₂ and a small proportion of CO, H₂S, N₂, NH₃, and heavy hydrocarbon.

Health hazards: Excessive high concentration of methane shall result in obvious decrease of oxygen content in the air and make people suffocated. When the content of methane in the air reaches 25% to 30%, it will result in headaches, dizziness, inactivity, aprosexia, tachypnea and palpitation, ataxia and even suffocation in case of failing to evacuate in time.

First aid: Evacuate from the site immediately to a place of fresh air. Keep respiratory tract unblocked and provide oxygen therapy in case of dyspnea. Conduct artificial respiration immediately in case of respiratory arrest and go to the doctor.

Combustion and blasting properties and fire protection:

Combustibility: combustible; Explosive limit (for methane, %): 5.3 – 15; ignition temperature: 538
Hazard characteristics: combustible and likely to form explosive mixture with air and incur hazards of combustion and explosion when caught in heat source and open flame. Reacting violently when in contact with bromine pentaoxide, chlorine, hypochlorous acid, nitrogen trifluoride, liquid oxygen, oxygen bifluoride and other strong oxidants.

Fire-extinguishing method: same as for ammonia. Emergency response to leakage accident: substantially same as for ammonia by spraying water for dilution and dissolution.

**Safety precautions:** No combustible and explosive articles and smoking are permitted in the biogas production area where fire protection facilities must be provided. The biogas system must be subject to frequent inspection to prohibit and fix any air leak. The gas tank, the biogas pipeline and the relevant equipment must be kept at positive pressure. Anti-explosion motors must be used for the biogas production and storage areas. Unauthorized access to poisonous and hazardous anaerobic digestion devices, ditches, ducts, underground wells and rooms and gas tanks is prohibited. Gas tanks shall be released at intervals and one-off emission to the air environment is prohibited when it is reasonably necessary to empty the gas tank.

(III) Identification of sanitary set-back distance

According to statistics of refuse landfills in China and calculation of sanitary set-back distance, the distance of odor impact is approximately 500m, which, therefore, is determined as the sanitary set-back distance of this Project. Use of land within a range of 500m around the Project shall be subject to strict control and sensitive targets such as residential communities and cultural and entertainment facilities are prohibited.

(IV) Analysis on compliance to industrial policies

According to the “Regulation Directory for Industrial Structure” (Version 2005) published by the national government, projects of integrated use and treatment of “wastewater, waste gas and solid wastes” belong to the category of encouraged projects. Therefore, this Project complies with the requirements of the relevant national industrial policy.

(V) Analysis of plane layout

The Project has a compact general layout and a smooth technological process and conforms to the fire protection requirements for a biogas project; with the biogas power
generator set is located on the northern end of the production area with a certain set-back distance from the boundary and the biogas storage tank, possible impacts arising from biogas risks are effectively reduced; the biogas residue and effluent products are stored in the southern part of the plant area and the main entrance is located in the southwestern part, facilitating easy transportation; the reasonably layout of the site landscaping with clear demarcation of different levels helps reducing the environmental impacts of odor and noises. In general, the Project’s general layout is reasonably designed.

(VI) Public Participation

1. Purpose of Public Participation

The purpose of public participation is to make the public aware of the basic information of the local environment and the Construction Project, investigate into the public’s recognition and comments on the construction of the Project and identify the environmental concerns of the public and guide the development of a reasonable environmental protection solution by introducing the basic information of and possible environmental issues arising from the proposed Project to the relevant parties of the Project and the impacted public in the neighborhood.

2. Methodology and Organization

The public participation under this Project is to be carried out following the requirements of the Chinese laws and regulations and the World Bank operational policies and using the experiences of successful similar projects in China. Questionnaires shall be issued according to the provisions in the “Provisional Measure of Public Participation in Environmental Assessment” to solicit comments, suggestions and requirements on the Project from the extensive public, in particular, the public groups exposed to direct impacts from the proposed project, settle the queries and problems pointed out by the public and work out alleviation actions to solve the environmental problems.

In order to make sure the public participation activities are carried out more effectively, a working group on public participation is established involving members from the Project Implementation Agency (Shandong Minhe Animal Husbandry Co., Ltd.) and the EIA agency (Shandong Academy of Environmental Science). The public
participation shall be organized by Minhe and steered by Shandong Academy of Environmental Science.

One public participation was organized as a part of this EIA according to the requirements of the World Bank in order to obtain adequate information on the public opinion on and level of satisfaction about the actions for alleviating the environmental impacts involved in the Project.

3. Method of Implementation

The public participation survey is carried out by means of real name questionnaire and the public opinions and suggestions on the proposed large excrement and sewage treatment and biogas power generation project. A meeting was convened in the meeting room of Minhe on September 12th, 2006 and Minhe and the EIA agency organized 50 participants including the villagers in the neighborhood and personnel from relevant departments to solicit their opinions on the proposed project. In order to ensure that the public opinion on the proposed project as a whole is fully reflected in the public participation and the survey objects are adequately representative, the participants included representatives from the Project Implementation Agency, governmental authorities (of animal husbandry, agriculture, environmental protection, planning, county, township and village governments), other organizations or institutions (in scientific research, schools, science association, agriculture and animal husbandry promotion organizations, breeding enterprises, processing enterprises, shops, etc.), farmers and residents in the neighborhood, stockmen and so on. The respondents represented citizens of different ages, professions, jobs and educational backgrounds and included teachers, scientific researchers, governmental officials and workers. At the meeting, basic information of the Project was introduced, discussions were organized and questionnaires were issued and completed.

4. Key Issues Covered in the Survey

(1) Project overview (project site, excrement and sewage treatment capacities, key technologies and processes, output of biogas and organic fertilizer, total project investment)

(2) Basic information and education background of the investigated

(3) Questions:

a） Are you satisfied at the environment as it is now? (Fully Satisfied; Not
<table>
<thead>
<tr>
<th>Question</th>
<th>Response Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) Are you familiar with the project of biogas-based excrement treatment and power generation and organic fertilizer processing?</td>
<td>(Very familiar; Fairly familiar; I’ve never heard of it)</td>
</tr>
<tr>
<td>c) How serious is the environmental pollution caused by excrements from breeding farms?</td>
<td>(Serious, Not too serious, I don’t care)</td>
</tr>
<tr>
<td>d) What’s your attitude towards the action of pollution control of excrements of animal husbandry?</td>
<td>(Supportive, Opposed, I don’t care)</td>
</tr>
<tr>
<td>e) Do you have any knowledge of the CDM excrement treatment and biogas power generation project?</td>
<td>(Very familiar; A little bit; I have no idea)</td>
</tr>
<tr>
<td>f) From where did you get information of the Project?</td>
<td>(TV, friends, family, newspaper, other channels)</td>
</tr>
<tr>
<td>g) Do you know about carbon trade?</td>
<td>(Yes; No)</td>
</tr>
<tr>
<td>h) Are you willing to allow the excrements from your estate (organization) to be treated under the Project?</td>
<td>(Yes; No)</td>
</tr>
<tr>
<td>i) What do you think are the positive impacts that might arise from the Project on your life?</td>
<td>(alleviation in water pollution, air pollution, soil pollution and agricultural product pollution, lower power consumption, increase in supply of organic fertilizers, higher income, more job opportunities, higher living standard and others)</td>
</tr>
<tr>
<td>j) What do you think are the negative impacts that might arise from the Project on your life?</td>
<td>(noise, land occupation, increase of waste in construction phase)</td>
</tr>
<tr>
<td>k) Significance of the negative impacts likely to arise from the construction of the Project</td>
<td>(Most significant; Not quite significant; I don’t care)</td>
</tr>
<tr>
<td>l) What actions could be taken to avoid or alleviate the aforementioned impacts?</td>
<td></td>
</tr>
<tr>
<td>m) Overall impacts from the construction and implementation of the Project</td>
<td>(Positive; Negative; Nearly no impact)</td>
</tr>
</tbody>
</table>
Do you support the construction of the Project?

Do you have any other comments and suggestions on the Project?

5. Summary of Survey Results

All of the 50 questionnaires released upon this survey were recovered and 100% of them are effective.

Here summarized as follows are the survey results:

♦ Educational background of the respondents: Elementary (24%), Secondary (16%), Tertiary (46%).

♦ Most of the respondents (54%) are satisfied while the remaining 46% are not quite satisfied at the environment as it is now.

♦ 75% of the respondents have some knowledge of the excrement treatment and power generation project while 8% of the respondents said they are quite familiar with the Project and 9 respondents never heard of the Project.

♦ 100% of the respondents are supportive towards the existing project in the local area and 0% said they don’t care.

♦ Alleviation in air, water and soil pollution takes the highest percentage (92%) of the positive impacts that might arise from the construction of the Project on the life of the respondents, followed by increase of income (52%), lower power consumption (26%), higher living standard (24%) and more job opportunities (48%).

♦ 78% of the respondents believe the construction of the Project might bring negative impacts on their life while the other 22% s don’t care. Noise (48%) and land occupation (26%) received the highest concern among the negative impacts as mentioned. 10 residents mentioned the impacts from increase of wastes and wastewater discharge during the construction phase of the Project and 100% of the respondents believe the impacts are insignificant or negligible.

♦ Some of the respondents wish the local supply of power for agricultural
purposes may be increased as a result of the implementation of the Project (this is not an item in the questionnaire).

- 96% of the respondents believe the construction of the Project shall produce positive impacts in general on their life and the environment.
- 100% of the respondents support the construction of the Project.

6. Conclusion of Public Participation

An analysis on the results of public participation survey indicates that the public are relatively concerned about the construction of the excrement and sewage treatment and biogas power generation project of Shandong Minhe Animal Husbandry Co., Ltd. Noise and wastewater discharge during the commissioning and operation phases are the hot issues concerned by the public and most of the public support the construction of the Project provided that the various environmental protection and control measures are properly carried out to ensure that pollutants are discharged in compliance with the standards and the environmental functional zoning requirements are satisfied. A large number of constructive advices and requirements were raised by the respondents expecting the implementation agency shall minimize the adverse impacts of the Project on the surrounding environment by carrying out the control measures and recommendations included in the EIA. Further improvements and revisions were made by the supplier to the noise and wastewater treatment proposals in pertinence to the public concerns on pollution from noise and wastewater discharge and the discharge standards are realizable.

This public participation survey was carried out with an extensive coverage and appropriate methodology and substantially covered residents of the key villages and towns impacted by the Project. The investigated group are highly representative, the public participation questionnaires are highly recovered and the survey results are impartial and objective.
## Preventive & Control Actions to be Taken under the Construction Project and Anticipated Results

<table>
<thead>
<tr>
<th>Content Type</th>
<th>Source of Pollution</th>
<th>Name of Pollutants</th>
<th>Preventive &amp; Control Actions</th>
<th>Anticipated Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air pollutants</strong></td>
<td>Biogas power generator set</td>
<td>SO$_2$, NO$_x$</td>
<td>Fuel biogas</td>
<td>“Comprehensive Emission Standard for Air Pollutants” (GB16297-1996) Table 2, Class II</td>
</tr>
<tr>
<td></td>
<td>Homogenizing grit chamber Pretreatment process Biogas effluent storage tank</td>
<td>Odor</td>
<td>Biological odor control device Covering, enclosing and landscaping separation and other actions</td>
<td>“Emission standard for odor pollutants” (GB14554-93) Class II</td>
</tr>
<tr>
<td><strong>Water Pollutants</strong></td>
<td>Production</td>
<td>Biogas effluent</td>
<td>Reused as organic fertilizer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic</td>
<td>COD NH$_3$-N</td>
<td>Reuse in production</td>
<td></td>
</tr>
<tr>
<td><strong>Solid Wastes</strong></td>
<td>Production</td>
<td>Biogas residue</td>
<td>Sold as organic fertilizer</td>
<td>All solid wastes shall be properly handled through comprehensive utilization and appropriate treatment.</td>
</tr>
<tr>
<td></td>
<td>Homogenizing grit chamber Sediments and small amount of excrement residues</td>
<td></td>
<td>Transported for non-hazardous disposal and treatment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic</td>
<td>Domestic wastes</td>
<td>Cleared and removed by environmental sanitation department</td>
<td></td>
</tr>
<tr>
<td><strong>Noise</strong></td>
<td>Equipment of low noise level shall be selected and actions of vibration reduction, silencing, sound insulation and reducing noise level through landscaping shall be taken on water pumps, blowers and the cooling towers and heat exchangers to satisfy the Class II standard of noise at boundary of industrial enterprises.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>Electromagnetic radiation: Same as the input power line of the existing project, the 10KV output power line of the Project mainly runs through mountains and farmlands and is kept far from villages and shall not produce any impact on the residents.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Ecological protection actions and anticipated results**
Construction phase: Proper compaction shall be achieved upon land leveling to prevent soil erosion.

Operation phase: Stronger efforts shall be made in the landscaping and management of the plant area to achieve a landscaping rate of 35%; Proper species shall be selected and planted to eliminate odor and reduce noise and prevent soil erosion. Sludge shall be transported to landfills for proper disposal to avoid repetitive pollution.

Therefore, the ecological protection actions designed for the Project are feasible and produce no obvious impacts on the regional natural environment and the anticipated results of environmental protection shall be achieved.

Conclusion & Recommendation

I. Conclusion

1. Implemented by Shandong Minhe Animal Husbandry Co., Ltd., the Biogas Engineering Project of Excrement and Sewage Treatment and Resource Utilization shall produce renewable energy (biogas, electric energy and heat energy) and organic fertilizers (in solid and liquid states) through the treatment of the organic wastewater of high concentration from the chicken farms of Minhe. The proposed Project is designed to treat 500t/d of fresh chicken excrement (with a moisture content of around 80%) and 1000t/d of wastewater from the washing process and generate 19,710,000 kWh of electricity each year. Involving a total investment of 63,678,500 RMB¥, the Project is listed in the “Regulation Directory for Industrial Structure” (Version. 2005) published by the national government and complies with the requirements of the relevant national industrial policy.

2. The proposed Project Site is located at Qujiagou Village, Beigou Town, Penglai City, Shandong Province in the broiler chicken breeding base of Shandong Minhe Animal Husbandry Co., Ltd. Approximately 7.5km southwest of Penglai, the proposed Project is surrounded by farmlands and fruit tree land and the geographical location of the Project Site conforms to the municipal planning of Penglai City.

3. The Project has a compact general layout and a smooth technological process and conforms to the fire protection requirements for a biogas project; with the biogas power generator set is located on the northern end of the production area with a certain set-back distance from the boundary and the biogas storage tank, possible impacts arising from biogas risks are effectively reduced; the biogas residue and effluent products are stored in the southern part of the plant area and the main entrance is located in the southwestern part, facilitating easy transportation; the reasonably layout of the site landscaping with clear demarcation of different levels helps reducing the environmental impacts of odor and noises. In general, the Project’s general layout is reasonably designed.

4. Dusts raised during the construction phase shall result in the increase of suspended
particulate matters in the air and pollution to the local air environment. Mechanical noises produced by the operation of the mechanical plants shall produce impact on the surrounding environment. However, these impacts are short duration and shall recover in a relatively short time after the Project is completed.

5. The power generator set involved in the Project shall be fueled with biogas, which shall be supplied to the power generator set after biological desulfurization and thus emits a very small volume of pollutants; screened collecting tanks and homogenizing grid chambers shall be provided in the pretreatment process and shall be covered and enclosed while odor generated from the pretreatment process shall be treated with the biological odor control device. Landscaping belts shall be provided and trees shall be planted to absorb odor and separate the key sources of pollution; since the Project Site is located in a relatively spatial environment where no villages are present in the short distance, little impact shall be produced on the ambient air environment.

6. An analysis on the environmental impacts on surface water indicates that the Project shall treat 1000m$^3$ of wastewater each day from the breeding farm after it is put into operation and the biogas effluent generated from the treatment process shall be used as liquid organic fertilizers in the farmland around the plant area and produce no impact on the surface water in the adjacency. A storage tank with a capacity of 50,000m$^3$ shall be constructed under the Project for storage of biogas effluent. In addition, farmers who utilize the biogas effluent shall also construct their own biogas effluent storage tank with a total capacity of more than 120,000m$^3$. These storage facilities shall fully satisfy the need for storage of biogas effluent in non-fertilization seasons and no environmental pollution shall result from discharge of excessive biogas effluent for reasons of inadequate space of storage.

7. Effective leakage-proof and anti-seepage actions shall be taken and the biogas effluent and residue shall be utilized and applied as needed at fixed and controlled application magnitude and frequency to avoid possible waste and loss of and ensure scientific application of the fertilizer. No adverse impacts shall be produced on the ground water during the operation of the proposed Project and the regional ground water environment shall expect improvements due to the alleviation of the existing environmental impacts by the pollution of surface water on the ground water environment.

8. Key noise-producing equipment including the pumps and blowers involved in the Project shall be installed indoors and corresponding noise reduction actions shall be taken for minimization of the noise level and, in addition, since the key noise-producing equipment has a certain distance from the boundary of the plant area, the Project shall comply with Class II standard specified in (GB12348-90) “Standard of noise at boundary of industrial enterprises”.

9. Biogas residue produced in a daily capacity of 60.91 ton under the Project (with a moisture content of 65%), as a semi-finished organic fertilizer, may be sold as quality fertilizers after the moisture content is decreased to below 25% through drying in Phase II. Sand grits and small amount of excrement settled in the homogenizing grit chamber shall be collected and transported to the non-hazardous garbage treatment plant for disposal and treatment. Domestic refuse produced in the plant area shall be subject to centralized treatment by the environmental and sanitation department. With the solid wastes properly treated, the Project shall produce no significant impacts on the environment.

10. The floors of the production areas in the plant shall be paved and strict
leakage-proof actions shall be taken in the collection, transportation and treatment of wastewater and effluents and stronger efforts shall be made in the management and prevention of leakages and spillages. Therefore, the impacts on ground water in the surrounding area shall be extremely minor.

11. The key environmental hazards involved in the Project shall be the leakage and explosion of biogas. Operators shall be trained to become adequately aware of the combustion and explosion characteristics and health hazards of biogas and familiar with the fire extinguishing and emergency leakage response actions. Effective safety precautions shall be taken and rehearsals shall be organized to minimize the level of such hazards.

12. The output power line of the Project is identical to the input power line of the original project. Located far from the villages and adopting a transmission voltage of 10KV, the power line of the Project runs over mountains and farmlands and produces no impact of electromagnetic radiation on the local residents.

To sum up, this Project is an environmental protection project aiming at control of pollution and improvement of environment and shall enjoy remarkable environmental and social benefits. Little impacts shall be produced on the surrounding environment on the condition that the aforementioned actions are taken. Therefore, the Project Site is reasonably selected and the project construction is feasible from the perspective of environmental protection.

II. Recommendations

1. During the construction period, water shall be sprayed and other effective actions shall be taken to prevent dusting and spillage of materials in transportation.

2. Management of construction activities shall be reinforced to ensure that no construction activities are conducted outside the specified time period (6:00 to 22:00) to prevent noise disturbance to the residents’ life.

3. Flowers and trees shall be planted, lawns shall be provided and arbors and shrubs shall be planted on both sides of the roads to promote the landscaping rate inside the plant area; phoenix trees, locust trees and other tall trees shall be planted on the boundary of the plant area to form a multi-level shelter belt to alleviate the odor and noise impacts on the ambient environment.

4. Internal environmental management in the company shall be reinforced to make sure the environmental protection actions are implemented, the facilities are in normal operation and assistances are provided to enable the local environmental protection authorities to carry out the monitoring activities.

5. Greater efforts shall be made in the job training for operators of biogas devices to enable them to master the operational procedures and techniques so that the safety procedures are better managed.
NOTE

I. The following annexes and drawings are attached to this Report:
   Annex 1  Approval of Project Proposal
   Annex 2  Other EIA-related Administrative Documents
   Figure 1  Geographical Position Map of the Project (indicating the administrative division, water system and positions of pollutant receiving inlet and terrain and topography, etc.)
   Figure 2  General Layout Plan of the Project

II. One to two of the special assessments described as follows shall be conducted in accordance with the features of the Construction Project and the local environmental properties in case this Report fails to describe the pollution arising from and environmental impacts caused by the Construction Project.
   1. Special Assessment on Impacts on Air Environment
   2. Special Assessment on Impacts on Water Environment (incl. Surface & Ground Water)
   3. Special Assessment on Impacts on Ecological Environment
   4. Special Assessment on Impacts on Soil Environment
   5. Special Assessment on Impacts on Sound Environment
   6. Special Assessment on Impacts from Solid Wastes and Exhaust Gas

   Additional special assessments not included in the aforementioned list may be raised and the special assessments shall be conducted in accordance with the requirements specified in the “Technical Guidance on Environmental Impact Assessment”.
Registration Form for Environmental Protection Review and Approval of Construction Projects

**Project Site:** Qujiagou Village, Beigou Town, Penglai City

**Biogas Engineering Project for Excrement & Sewage Treatment and Resource Utilization**

**Scope & Size:**
- New: ☐
- Reconstruction / Expansion: □
- Technological Renovation: ☐

**Description:**
- Biogas production and power generation; Treatment capacity: 500t/d chicken excrement;

**Nature of Construction:**
- Type of Environmental Protection: ☐
- Management: ☐
- Protection: ☐

**Environmental Control No.:** N3725

**Investment in Environmental Protection:**
- Total Investment: 6367.85 ¥
  - Percentage: 100%

**EIA Outlay:**
- Processed: 6367.85 ¥

**Approval Ref. No.:**
- Organization: Shandong Academy of Environmental Science
- Shandong Minhe Animal Husbandry Co., Ltd.
- Address: 2-3 Nanguan Road, Penglai
  - Postal Code: 265600
- Tel.: 0531-85870050

**Certificate:**
- State EIA Certificate No. 2402
- Project Status of Approval:
  - Approved: 2010-0001
- Reduction due to Emission: 0%
- Increase / Decrease: +0%
- Reducing due to "Replacement Campaign": 0%
- Reduction in Emission Volume in Total: 0%

**Pollutant Discharge Compliance and Total Control:**

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<th>Pollutant</th>
<th>Computer Emission Concentration</th>
<th>Predicted Emission Concentration</th>
<th>Approved Emission Concentration</th>
<th>Actual Emission Concentration</th>
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**Pollutant Discharge:**
- Wastewater: 10,000 ton/year for industrial solid waste discharge, mg/m³ for air pollutant emission concentration, ton/year for water pollutant emission volume and air pollutant emission volume.

**EIA Agency:**
- Shandong Environmental Protection Bureau

**Approval Ref. No.:**
- Shandong Academy of Environmental Science
- Shandong Minhe Animal Husbandry Co., Ltd.
- Address: 59 Lishan Road, Jinan, Shandong
  - Postal Code: 250013
- Tel.: 0531-85870050

**Environment Characteristics:**
- Ambient Air (GB3095-2008) Level 2
- Water Quality Protection Area
- Key Function Area
- Forest Park
- Primarily Populated Area

**Name of Organization:**
- Shandong Academy of Environmental Science
- Shandong Minhe Animal Husbandry Co., Ltd.

**Legal Representative:**
- ZHANG
- SUN Ximin

**Contact:**
- 0531-85870050

**Address:**
- Shandong Academy of Environmental Science
- Shandong Minhe Animal Husbandry Co., Ltd.
- 2-3 Nanguan Road, Penglai
- Tel.: 0531-85870050
- Postal Code: 265600

**Preparation Ref. No.:**
- Preparation of Report Form: ☐
- Preparation of Registration Form: □

**Date of Proposal:**
- 2010-0001

**Date of Approval:**
- 2010-0001

**Project Site:**
- Qujiagou Village, Beigou Town, Penglai City

**Type of Report:**
- Preparation of Report Form

**Organization:**
- Shandong Academy of Environmental Science
- Shandong Minhe Animal Husbandry Co., Ltd.

**Completed by:**
- (Signature)

**Prepared:**
- (Signature)

**Handed by:**
- (Signature)

**Date:**
- 2010-0001

**Total Investment (10,000RMB):**
- 6367.85 ¥

**Nature of Construction:**
- New: ☐
- Reconstruction / Expansion: □
- Technological Renovation: ☐
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<th>Action Taken</th>
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<td>Way of Resettlement</td>
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<td>Relocation</td>
<td>Backward Resettlement</td>
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<th>Monitoring &amp; Management</th>
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