

English translation of
Environmental Impact Assessment of Dengloujiao Windfarm, Guandong Province, China

Report on Environmental Impact from Construction of Dengloujiao Windfarm Project

Project Name: Wind farm of Dengloujiao, Jiaowei Town, Xuwen County, Zhanjiang City, Guangdong Province

Evaluation Unit (sealed): Climatic and Agrometeorological Center of Guangdong Province

Date of preparation: February 18, 2008

Qualification Certificate for Environmental Impacts Evaluation of Construction Projects

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Grade of certificate: Grade II

Certificate No.: GuoHuanPingZhengYiZi No.: 2804

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Project name: Wind farm of Dengloujiao, Jiaowei town, Xuwen county, Zhanjiang city, Guangdong province

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Legal representative: Qian Guangming (signature)

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Principal of project: Wu Yanbiao (signature)

Jing Lijia is hereby registered since evaluation qualification on environmental impacts and relevant business has been acquired, as verified by the Registration Office of Professional Qualification of Environmental Evaluation Engineer in Ministry of Environmental Protection of PRC

Certificate No. of professional qualification: 0006733

Number of Registration: B28040040600

Expiry date: December 31, 2007 to December 30, 2010

Employer: Climatic and Agrometeorological Center of Guangdong Province

Type of Registration: environmental impacts evaluation of construction materials and thermal power

Ministry of Environmental Protection of PRC
December 31, 2007
(Sealed)

Project name: Wind farm of Dengloujiao, Jiaowei Town, Xuwen County, Zhanjiang City, Guangdong Province

Trustor: GUANGDONG YUENENG GROUP CO., LTD

Trustee: Climatic and Agrometeorological Center of Guangdong Province

Certificate No.: GuoHuanPingZhengYiZi No.: 2804

Legal representative: Qian Guangming (Senior Engineer)

Principal: Song Lili (Senior Engineer, Professor Grade)

Project principal: Wu Yanbiao (Senior Engineer)

Report prepared by:

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Basic conditions of construction project

Project name	Wind farm of Dengloujiao, Jiaowei Town, Xuwen County, Zhanjiang City, Guangdong Province				
Construction unit	GUANGDONG YUENENG GROUP CO., LTD				
Legal representative	Lin Lihe	Contract			Yang Yang
Address	20/F, Yueneng Mansion, Suite 6, No. 45, Tianhe Road, Guangzhou				
Tel	020-38306126	Fax	020-38306139	Zip code	510075
Construction site	Jiaowei Town, Xuwen County, Zhanjiang City, Guangdong Province				
Examination & approval authority	Development and Reform Commission of Guangdong Province		Approval No.		
Project type	New; Renewal & Extension; Technical reform		Type of industry & code		Wind power D-44
Land area (sq.m.)	94290		Green area (sq.m.)		30%
Total investment (10 thousand RMB)	50,078.56	Including: investment for Environmental protection	163.15	Env. Pro. Into total inve.	0.326%
Project scale (MW)	49.5	Expected date of putting into construction		December, 2009	
<p>Project content and scale thereof:</p> <p>Guangdong Yueneng (Group) Co., Ltd. intends to establish a wind farm in the tidal flat of Jiaowei Town, Xuwen County, Zhanjiang City, Guangdong Province. The scale of the project is expected to be 495,000 kw, involving 33 sets of 1500kw wind turbine generator systems (WTGS) and accordingly 33 sets of 35kv Box-type transformer substation. All these facilities would be provided in the tidal flat with altitude of 10m. The generating capacity is expected to be 101,384 MWh, saving standard coals of 35100 tons yearly. Electricity lead-in system would be 110kv while the lead-out system would be 110kv to the Maicheng substation (110Kv) near the wind farm. The section of conducting wires would be 300mm², with length of 20km. For the project, a booster station (110kv) should also be constructed.</p> <p>The project involves a static investment of RMB485, 101,200, and total investment of RMB500, 785,600. The permanent land covered for the wind farm involves the motor foundation, transformer foundation, path (extension for 10km, including renovation for 5km, and new construction for 5km), etc, totaling 94,290m². Interim land use for construction works is mainly for RC bar prefabrication plant, interim residential area and offices, materials deposit and storages, interim deposit area for equipments, and concrete fabrication as well as other auxiliary facilities, totally 93,671.4m².</p> <p>As per the geological conditions of the site, foundation made of RC bars should be employed for</p>					

the motor foundation since it is located in the tidal flat, adopting earthwork excavation.
Rated labor force shall be 14 people for works at present.

Existing pollutions and major environmental issues in connection with the project:

No obvious Industrial pollutions are discovered within project site. Therefore, the construction environment is expected to be fairly favorable. The establishment of a wind farm would contribute to providing clean energy for economy development and minimizing pollutions.

Natural environments and social conditions of project site:

Brief introduction of natural environments (landscape, landform, geology, climate, hydrology, vegetation, variety of species):

1. Geographical location

Zhanjiang city, located in southmost end of the country, is in the southwest part of Guangdong province, with $109^{\circ}31' \sim 110^{\circ}55'$ of eastern longitude and $20^{\circ} \sim 21^{\circ}35'$ of north latitude, covering the whole Leizhou Peninsula and part of areas in north of the peninsula. With South China Sea in the east, Qiongzhou Strait in the south, Hainan province in the opposite, the Gulf of Tonkin in the west, Hepu, Bobai and Luchuan of Guangxi Zhuang Autonomous Region in the southwest, as well as Maoming city and Dianbai County in the northeast, the city enjoys a favorable geographical environment. The downtown area of the city is located in the northeast of Leizhou Peninsula, with $110^{\circ}4'$ of north longitude and 21° of north latitude.

Xuwen county is located in southmost end of the country, with $109^{\circ}52' - 110^{\circ}35'$ of east longitude and $20^{\circ}13' - 20^{\circ}43'$ of north latitude. Surrounded by the sea in three sides, the county is only 150km far away from Zhanjiang city and 18 sea miles far away from Haikou city, and is known as a crucial point to Hainan province from the mainland. The County enjoys a high convenient traffic and transportation: 207 State Highway and Guangdong-Hainan Railway passing from the north to the south, the domestic largest automobiles ferry dock (Hai'an Harbor) and Guangdong-Hainan Railways ferry dock (the second largest of its kind in Asia). The expected wind farm is expected to be in Jiaowei Town, Xuwen County – southmost end of Xuwen county and only 30km far away from the county town. Surrounded by the sea in three sides, the station is expected to be in a long and narrow form, with span varying from 8km to 10km. Please refer to Fig. 1 as attached for detailed geographical location of the project. Refer to Fig. 2 as attached for the plan of the wind farm.

2. Climate

Xuwen County belongs to the tropical monsoon climate, with sufficient sunshine and high temperature all the year round, non-conspicuous four Seasons yet sufficient rainfall, subject to sharp variations over years. In rainy seasons, it is also hot. It has

evident rainy and dry seasons. The mean temperature is 23.3⁰C yearly. The mean temperature monthly is over 15⁰C. July has the highest monthly mean temperature – 28.4⁰C. The lowest monthly mean temperature is 16⁰C. The highest temperature occurred once over years – 38.8⁰C in 1958 and the lowest one is 2.2⁰C in 1967. Active cumulative temperature daily over the year higher or equivalent to 10⁰C is 8458.1⁰C; the average rainfall yearly is 1364.1mm. However, the rainfall over the seasons distributes unevenly and the summer and fall seasons have the largest rainfalls. Furthermore, the rainfall over years varies sharply and the average is 22%. That is why dry weather is a commonplace. Typhoon is frequent in the summer and fall seasons, with an average of 3.5 times annually. Months from July to September have 71% of typhoons .

3. Landscape, geology, soil and vegetation

Xuwen County is surrounded by sea in three sides, enjoying a coast line of 371.87km and various fleets. The landform within the county varies – higher in the north and in the center, inclining to the three sides surrounded by sea. Shibao Mountain in the north has an altitude of 245.4m – the peak of the County. Mesas formed from volcanic lava and volcanic hills are everywhere in the north and center of the county. Beach sketches with sand bays and plains and terraces are distributed here and there. Rivulets and rivers are narrow and short with origins mainly in the north center of the County, flowing to the sea in the three sides. There are three types of landforms divided as per forms: 1) volcanic lava mesa and volcanic hills, accounting for 60% of total area of the country; 2) aqueous landforms such as beach, alluvial sand bays, alluvial plains, alluvial terrace and abrasion terrace (five in all), accounting for 39% of total area of the County, and 3) running water landform, lake-formed landform and man-made landform, etc., accounting for 1% of total area of the county.

The coastline within Xuwen County is flexuous. There are various gulfs and small with simple landforms and landscapes, mainly in the form of volcanic lava mesa and volcanic hills. The area develops four levels of basalt mesas, with the first and the second levels smooth and flattened, and the third and the fourth levels wave a little (the depth cut reaches 10m). The volcanic hills are mainly with an altitude within 100m ~ 150m. Within the narrow coastal plains, fixed and semi-fixed sand hills are everywhere, with some moveable sand hills concurrently exist. This phenomenon is mainly owing to the abundant sands, seasonal dry climate and strong winds. As a matter of fact, during the period of intensive vaporization under the high temperature environment, even the area with rich rainfall may become dry and deserted.

As it is in the tropical area, Xuwen County belongs to the monsoon climate which characterizes in sufficient sunshine and hot temperature. The mean temperature yearly is 23.3⁰C whereas the annually rainfall is 1364mm on average. Therefore, the land is fertile – as a base of tropical crops. The natural vegetation is mainly of tropical rain forests and monsoon forests, then rarely-scattered trees and shrubs as well as

mangroves. The species of plants are abundant, such as the following six particulars: rainy season trees, savanna trees and shrubs, thorny shrubs, mangroves and shrubs, savanna and sand desert steppe.

Social environment (social & economic structures, education, culture, cultural relics protection, etc):

Xuwen County covers an area of 1779.63km², with a population of 630,000. 18 towns are directly governed under it. Furthermore, there are also a farm run by the county and Hai'an economic development experimental zone; five state-owned farms and one rubber researching institution are located in the county.

As it is located in the tropical area, the climate is mild, with long sunshine hours and fertile lands. Furthermore, it also possesses long tidal flat. The agricultural and sideline products are abundant, with industrial crops such as sugarcanes, pineapples, bananas, mangos, vegetables, etc; pasturage products mainly go in scalpers, goats, etc; sea products such as genuine pearls, prawns, high quality fishes, etc. As such, the area possesses the large diatomite ore deposit of the country – more than 100 million tons. Tidal flat favorable for salt producing totals 5333 hectares. Typhoon is a common during summer since it is affected by tropical oceanic monsoon climate. The County possesses mainly renowned fruit brands – purple flower mango enjoys a famous brand of International Agriculture Exhibition. In recent years, 20 high-standard agricultural demonstration zones have been established in response to the promotion for development of domestic agriculture and counter-season agricultural products.

There are 425 middle schools and primary schools within the county (excluding schools in farms), including five high schools, one vocational senior middle school, 23 senior middle schools, 250 primary schools, and 157 teaching places. There are 60 private founded schools, including two middle schools and 58 primary schools.

Environmental quality

Environmental quality of project site and major environment problems (air, ground water, underground water, noises, ecological environment):

Environmental situation within the area:

1) Air

There are few Industrial zones within Xuwen County where the project site locates – the daily average concentration of sulfur dioxide (0.003mg/m³), nitrogen dioxide (0.008mg/m³), and absorbable particles (0.100mg/m³) can meet grade I standard.

2) Water

The environmental quality of the marine area within Xuwen County is favorable. Water quality within the sea area near the coasts satisfies requirements for various functions.

3) Noises

Noises within the area are lower than 50db both during the daytime and the night, being within the Grade II state level.

To conclude, the environment within the area is fairly favorable. Therefore, it is highly crucial for a sustainable economy development.

Major environmental protection objectives (Roll call and protection grade):

1. Minimize the impacts on the local vegetation arising out of works during the construction period. The damaged vegetation should be restored upon completion of construction.
2. Sanitary sewage from the wind farm shall be treated before being discharged. Obvious impacts on the water quality within the sea area shall be prohibited.
3. Wastes from construction works and domestic wastes and other solid wastes shall be controlled. The deposit, storage, handling, etc. of domestic wastes shall be strictly controlled. It is suggested that the domestic wastes be packed and delivered to professional department so that they may be properly treated. Obvious impacts on the surrounding environments shall be prohibited.

Applicable standards for evaluation works

Environmental quality standard	<ol style="list-style-type: none"> 1. "Sea Water Quality Standard" (GB3097-1997) Class II standard; 2. "Ambient Air Quality Standard" (Revised in 2000) Class I standard; 3. "Standard of Environmental Noise of Urban Area" (GB3096-93) Class II standard; 4. "Environmental Quality Standards for Surface Water" (GB3838-2002) Class II standard.
Wastes discharge standard	<ol style="list-style-type: none"> 1. "Guangdong Local Discharge Standard – Discharge Limits of Air Pollutants" (DB44/27-2001) Class II standard; 2. "Guangdong Local Discharge Standard – Discharge Limits of Water Pollutants" (DB44/26-2001) Stage II, Class I standard; 3. "Standard of Noise at Boundary of Industrial Enterprises" (GB12348-90II standard – 60dBA during daytime and 50dBA during night); 4. "Emission Standard of Cooking Fume" (Interim) (GW18483-2001).
Overall control indicator	

Engineering analysis of construction project

Brief introduction of production flow (see figure illustration):

Since the project intends to make use of wind force – a reproducible energy – for generation of electric power, the major construction process is as follows:

Detection and analysis of wind force resource → site selection of wind farm
construction → and installation of wind turbine and facilities for electricity distribution
and transformer substation putting into use for power generation

Dose of production materials and auxiliary materials:

Physical and chemical properties of raw materials and auxiliary materials:

Major pollutants:

Wind force is a clean energy, with reproducible, non-pollution and inexhaustible features. Electricity generation of the project involves no waste water, exhaust gas, solid wastes and discharge of other pollutants. However, the installation of wind turbine requires for land. Furthermore, noises are sure to be generated during the operations of wind turbines. In addition, improper management of lubricant system of WTGS may lead to leakage of lubricant oils. The electric power transmission may also exert impacts on the local environment to some extent.

1. Land use

The wind farm is expected to cover a total area of 94,290m², including foundation for WTGS, foundation for transformers, roads, etc. Interim land use during construction works covers a total area of 93,671.4m², including land use for RC bar prefabrication, interim residential community and offices, storages for materials, interim deposit for equipments, concrete mixing and construction of other auxiliary facilities. The abovementioned land does belong to farmland. Damages to some extent to the local vegetation are unavoidable. However, no rare species are involved. Therefore, there would be no obvious impacts on the local zoological environment and the vegetation. Furthermore, no scenic spots and historical sites are involved by the site for wind farm.

2. Impacts on birds

As per reports of Birds Consulting Center of Denmark which acquired relevant data from observations of nine large-scale and middle-scale wind farms, WTGS would not exert material impacts on birds, that is, birds living in the neighborhood would generally get familiar with WTGS and keep a safe distance against it. Therefore, a wind farm would have bad impacts on migratory birds that are not familiar with the local environment.

However, the site of the wind farm is off the course of bird migration and wild bird species under special state protection are not found. Moreover, WTGS is installed at a high place – an elevation of 65m. Therefore, WTGS occupies comparatively small space and no adverse impacts on birds would be exerted.

3. Impact on landscape

Visual landscape is one of constraint factors in the event of the layout for wind farm and what people consider with regard to the scenic area equipped with WTGS, and the impact on WTGS shadow must be taken into account.

This WTGS site is located near Dengloujiao, Xuwen, far away from densely populated area, and has limited impact on natural landscape. On the other hand, people have great interest in visiting the scenic area equipped with WTGS in terms of few wind farms in China, therefore the construction unit could focus on aesthetics effect and take wind farm as a landscape for

sight-seeing in the event of design and construction on the location, road and related facilities of wind turbine.

4. Impact on radio communication jamming

WTGS will obstruct the transmission of the electromagnetic wave. In the light of WTGS impact, the electromagnetic wave can be reflected, scattered and diffracted, which means that WTGS may interfere the radio communication. The wind farm lies in the coast zone which is far away from densely populated area and will have no impact on radio and wire signal in residential area. Moreover WTGS generates lower AC frequency and voltage, without corona discharge and therefore the system will not interfere the transmission of high frequency electromagnetic wave, like telecom and TV.

5. Impact on acoustic environment

WTGS will generate certain noise during the operation, including mechanical and aerodynamics noises, where WTGS rotor mainly generates the mechanical noise while WTGS blade has the aerodynamics noise. As the environment noise is the one relative to human hearing, it is confirmed that there is no residential area around the project and only few residents live round this site of wind farm and therefore the WTGS operation will have no noise impact on the local residents.

The operation of wind farm is controlled by the computers, with no manual operation for individual wind turbine and all staff on duty in the station, infrequently close to the system, focuses on their work in the operator cabinet, therefore the operation will not have any impact on staff on duty regularly. The maintenance time is very short in case of requirement for field working. The project will not obviously affect the health of station staff on duty.

The station is proposed to adopt WTGS with 1500kW Single Dynamo Capacity and the noise on the hub is less than 100dB during WTGS operation under the standard conditions of 10m height and 10m/s wind speed. Each WTGS will be considered as a point sound source due to further distance between WTGSs. Based on calculation, the noise, 70m far away from Diurnal horizontal distance and 200m from night horizontal distance, can meet Class I standard of *Standard of environmental noise of urban area* (GB3096-1993), that is the requirements of diurnal 55dB and night 45dB. The noise, 200m far, is only 42dB in case the sound source is 100dB in the light of the test from European Wind Power experts. Two 42dB sound levels superpose into 45dB, and then the superposed noise value will be less in the event that contiguous turbine distance is farther and at least over 250m between turbines. Therefore the noise from wind power turbine will have no obvious impact on ambient acoustic environment.

6. Environment Impact on electromagnetic radiation

The construction unit of engineering project proposes to install gross capacity of 49.5 MW in the site and to equip with 33 WTGS with 1500kW Single Dynamo Capacity, and approximately 10138.4×10^4 kWh electric quantity will be provided for the grid every year after the commissioning. The wind farm is connected to the system with 110kV voltage, and the 110kV line is connected with ambient area around the wind farm. 110kV quick transformer, a new step-up substation in this phase, has 300mm² lead section, approx. 20km long. The ground power frequency electric field intensity of this 110kV Step-up substation is less than the standard of 4kV/m in case of 12m far distance, therefore the 110 kV electric and magnetic fields will not

obviously affect the ambient environment.

7. Environment Impact on lubricant

Lubricant for Lubrication system will drop to impact the environment in the event of improper management of WTGS. Therefore the management must be emphasized to avoid drop.

The pollution rising from the construction will be discussed in related parts below.

Production and expected emissions for main pollutant of this project

Type	Emission Source	Pollutant name	Concentration and quantity prior to disposal		Emission concentration and emission amount
Atmospheric pollutant	Employee canteen (14 employees)	SO ₂	Unorganized	Trace	Trace
		NO ₂		Trace	Trace
		CO		Trace	Trace
Water pollutant	Sanitary sewage	Sewage quantity	6.5m ³ /d		--
		COD _{cr}	180 mg/L;1.17 kg/d		≤90
		BOD ₅	90 mg/L;0.67 kg/d		Trace
		SS	300 mg/L;2.0 kg/d		≤60
		NH ₃ -N	25 mg/L;0.17 kg/d		Trace
		Plant and animal oils	20 mg/L;0.17 kg/d		Trace
Solid waste	Domestic waste	7.0 kg/d、 2.6t/a			7.0 kg/d 2.6t/a
Noise	Diurnal 55dB and night 45dB after device noise attenuation				
Others					

Main ecological impact (attach another page in case of unavailability):

The project has been installed with 33 WTGSs, in the form of 1500kW Single Dynamo Capacity and mainly used coastal tidal flat and vacancy plots. For a few Casuarina equisetifolia in the site, the wind farm inevitably lops off parts of vegetation and brings a few damage during the project construction, but no valuable and rare species is damaged, therefore no great impact on ecological vegetation is applied.

During the period of project commissioning and operation, no obvious impact has been applied to ecological environment, however some operations, such as base excavation of wind turbine, facilities transportation and material stacking etc, will affect the vegetation during the construction phase. Therefore the construction unit shall minimize the impact and take timely action to recover the vegetation as far as possible.

Environment impact analysis

1. Overview

With social development and improved living standard, more power has been consumed, where the thermal power mainly is based on the following fuels, like coal, oil and combustible gas. Some pollutants in atmosphere like sulfur dioxide mainly come from Thermal power station, however increased thermal power gives rise to high frequency acid rain in Guangdong Province, as well as polluted air environment, damaged ecological environment and buildings and serious economic losses. In consequence, the emission reduction of pollutants, like sulfur dioxide, will be one of important considerations of environment pollution control.

Wind-energy generation can never consume non-renewable resources, like coal, oil and combustible gas, avoid the pollution in each section of exploitation, transportation and generation of the fuels for thermal power, and reduce the consumption of fossil fuels resources, leaving more non-renewable resources for posterity.

The following comparison of pollutant emission between Coal Fired Power Plant and wind farm indicates the environmental benefit and economic and social efficiency.

Besides less pollution than thermal power station in construction phase, wind farm has more obvious advantages in the operation phase and the following aspects mainly present the difference of environment impact between the two stations, as shown in Table 1.

Table 1 Comparison analysis of environment impact by wind power and thermal power

Generation mode	Fuel, Traffic	Atmospheric pollutant	Water pollutant	Solid waste	Noise	Pollution control
Thermal power	Require road or dock for fuel transportation; at least consuming 275g/kWh coal equivalent	Emission of sulfur dioxide, nitrogen oxides, smoke, carbon monoxide, benzpyrene etc.	COD, sulfide, petroleum, high temperature water etc.	Fly ash, slag, desulphurized waste etc.	Approx. 100dB	Require the facilities for pollution control; construction and operation expenses for pollution control
Wind power	N/A	N/A	N/A	N/A	Approx. 50	N/A

From Table 1, the wind farm has simple operation content after the construction completion, without any non-renewable resources, funds investment for purchasing and using non-renewable resources, and pollutant emission, as well as no atmospheric and water pollution. Therefore wind farm does not require any expense of pollution control and has less operation cost. However the thermal power needs to continuously consume non-renewable resources (environment pollution in the whole course and each section of exploitation, transportation and generation of the fuels), and continuous labors and funds are required for the fuel combustion and pollution control during power generation; however pollution control is just to reduce the pollutant emission, other than zero release which is generally unavailable; the pollutant rising from the pollution control is possible to produce secondary pollution.

Approx. 10138.4×10^4 kWh electric quantity will be provided every year after the completion and commissioning. The wind farm will be capable of reducing 3.51×10^4 t coal equivalent, approx. 215.8t emission of smoke and dust, 11000t cinder quantity, 76500t CO₂, 9.33t CO, 3.71t hydrocarbon and 679.4t SO₂ every year. Therefore the project is of positive benefit to the environment protection and reduction of atmospheric pollution. Wind farm can increase generating capacity, without non-renewable resources consumption and increased pollution, and relatively reduce the environment pollution to access obvious efficiency related to environment, economic and social considerations.

2 Brief analysis on environment impact during construction period:

2.1 Environment pollution factors during construction period

The pollution factors, such as noise, fugitive dust and sewage etc will arise during the project construction period. With the analogy of the same pollution factors given rise to noise, fugitive dust and sewage etc in construction field, all these factors will to some extent impact the ambient environment in case of no proper disposal. The impact on ambient environment is as follows:

2.1.1 Noise

Noise, rising from the collision of equipment & machinery and material handling, is the main pollution factor in construction field. The highest sound level of all these noise can be 90dB (A).

2.1.2 Fugitive dust

The main reason for fugitive dust during construction is as follows: the dust arises from the transportation, handling and process of brick & stone and concrete and so on. The drifted dust will impact the natural environment around the station.

2.1.3 Sewage

Approx. 100 staff serve the project construction in the construction peak, and plenty of workers mobilize in the construction field. Therefore some sanitary sewage will be discharged. It is considered that with $0.2 \text{m}^3 / (\text{person} \cdot \text{d})$ domestic water, daily quantity of wastewater effluent is $25.6 \text{m}^3 / \text{d}$ in case water consumption of $32 \text{m}^3 / \text{d}$ in the peak, and emission factor of domestic water with 0.8. The main pollutant in the domestic water is SS and COD_{cr}.

2.1.4 Solid waste from construction

The construction project will generate some muddy residue during the construction while the some brick, waste wood and material will arise out of the building construction.

2.2 Recommendation for Pollution prevention measure during construction period of the project

The efficient prevention measures must be taken to prevent and control the environment pollution during the project construction period, for the purposes of minimizing the ambient

environment impact from the construction period. For this reason, it is recommended to adopt the following pollution prevention measures based on the experience in congener building site:

2.2.1 Reasonably arrange the construction by stages and time interval and well prepare the connection between time and space to reduce the impact scope and time. The time of each construction period and construction scope must be arranged and coordinated well to prevent the conflict between transportation vehicles and normal order of social life, i.e. setting bypass for the traffic- impacted road.

2.2.2 Housekeeping. The building site shall be isolated from ambient environment easy to be impacted to reduce the environment impact.

2.2.3 The related regulations of construction management should be strictly complied. The work, which may give rise to high noise, shall not be performed in the rest time (especially for noon break and night sleeping) in the event of being closer to residence place.

2.2.4 All facilities should be reasonably arranged to reduce use time of noisy devices, especially that of high noise devices, and the rules of working time may be established on the basis of no noise disturbance.

2.2.5 The muddy residue and waste material from the construction shall be well used or immediately carried away.

2.2.6 Clean transportation should be paid more attention to prevent the scattering of muddy residue from building site and material transportation. Standardized operation will be required for material handling to reduce the drifted dust and noise as far as possible during handling. Transportation vehicles should be maintained and all vehicles demobilizing from the building site should be clean regarding the appearance, and installed with carriage cover to avoid the environment pollution due to material scattering.

2.2.7 The sewage in the site should be well guided to discharge and completely recycled. Some sewage without recycling should be effluent after being filtered and precipitated, other than free discharge. The construction sewage should be paid attention to guide and discharge. The water for washing material and equipments can be recycled after being precipitated, which can not only reduce the usage of clean water, but also the sewage discharged outsides. Slag separation and precipitation should be applied to the required sewage for discharging outsides, as well as the inside floater should be removed and sediment content should be reduced, along with selected discharge direction, other than free discharge.

The sanitary sewage during construction period includes: canteen oily sewage and general sanitary sewage etc. The sewage from canteen includes some residue and plant and animal oils which may impact ambient water body. It is recommended that the sanitary sewage treatment plant should be built in the temporary residence for construction workers to dispose the sanitary sewage. The sewage processed by integrated equipment could be discharged into the sea area nearby.

In a word, during project construction period, some environment impacts will not be inevitable and the construction unit should endeavor to take some actions to reduce the environment impact from the construction on the basis of strong management and housekeeping as well as recover the vegetation in the event of project completion. In the view of other site experiences, the ambient environment impacts during construction period could be minimized and the economic development and environment protection could be coordinated well as long as the recommended measures above are well performed.

3. Analysis on environment impact during operation period:

3.1 Impact analysis over water environment

Calculated with 14 staffs, the max daily water usage is totally 7.8m³/d, including domestic water, dorm water, canteen water as well as green belt sprinkling and unforeseen water.

Sanitary sewage: the sanitary sewage system comprises septic tank, sewer pipe, integrated sewage treatment equipment, reclaimed water tank and general service pump. The sanitary sewage in various places will, upon the deposition process in septic tank, finally be gathered in the sanitary sewage adjustment pool set in the station in case the supernatant passes the sewer pipe, which will then be treated by integrated equipment upon meeting neutral water standard. In case of greenbelt irrigation, car wash or road rinsing in the station, the general service pump can be used manually. The water discharged from canteen upon separation tank is connected to sewage pipe network in the station and finally be gathered in the sanitary sewage adjustment pool. Sanitary sewage shall be treated and discharged upon meeting standard though the amount of sanitary sewage is not significant in the project, causing no obvious impact over water body.

3.2 Impact analysis over environmental air

Though flue gas will not be generated in the project, yet fume would still be produced from burning gas in kitchen for 14-staff food preparation, such as SO₂, NO₂ and CO, which will not generate obvious impact over air upon treatment by lampblack machine due to little pollution emission.

3.3 Impact analysis over sound environment

The project site is far from residential area and the noise, with diurnal and night 200m far away, caused by wind turbine generator which would meet the requirements of Class I standard of *Standard of environmental noise of urban area* (GB3096-1993). The superposed noise would not impose any obvious impact over the sound environment after the air attenuation due to farther space between wind turbine generators.

3.4 Impact analysis of solid waste

After being put into production, main generated solid waste would be domestic waste with the annual output as around 2.6t. Daily domestic waste from employees shall be collected in designated place and then turned over to the environmental and personal health department for treatment and disposal periodically and uniformly. In addition, sterilization and pest-killing work shall be done for the stacking place of domestic waste to prevent the emission of niff and growing of mosquitoes and flies, which may impact the environmental sanitation nearby. Through the said measures, solid waste will be ensured not to cause adverse effect over the environment.

Proposed control measures and expected effect of construction project

Type	Emission Source	Pollutant name	Prevention and control measures	Expected control effect
Atmospheric pollutant	Gas and smoke	SO ₂ , NO ₂ , CO	Lampblack machine etc.	Trace emission
Water pollutant	Domestic sewage	COD _{cr} BOD ₅ SS Petroleum Ammonia nitrogen LAS	Domestic sewage processed by integrated sewage treatment equipment	Trace emission
Solid waste	Domestic waste	Domestic waste	Pack and send the waste to Environmental and Personal Health Department for disposal	
Noise	Equipment noise	Less than 55dB (A) after noise attenuation		
Others				

Ecological protection measures & Expected effects

33 sets of wind turbine generator system (WTGS) with the single dynamo capacity as 1500KW are intended to be mounted for the Project. The project will be mainly constructed along the coastal tidal flat and open clearing where there are little trees and much *Casuarina equisetifolia* along the seaside. In the project, the earthwork excavation volume would be 33, 000m³, while the backfilling work would be 12, 000m³, and the work volume of concrete and steel (excluding pre-stressed concrete drilling pile) would be respectively 22, 000m³ and 1, 530t. It's required that the construction unit shall make all efforts to reduce the excavation area and material stacking area. Ground free of trees shall be selected as much as possible for every set of WTGS mounting, thus imposing less or no impact over the forest and reducing damage to forestation. The principle set during construction shall be occupied with no or less woodland. In addition, the construction unit shall step by step restore the vegetation during work, clean off the site upon completion of the work, and recover any vegetation damaged by the work, reducing the impact over vegetation caused by construction work and operation; furthermore, the construction unit shall compensate for any damage to forest tree as per relevant regulations. In the event that it's essential to occupy or expropriate woodland, the construction unit shall, subject to the examination and approval of the Woodland Administration Authority of the People's Government over county-level, go through the examination & approval formalities of land used for building as per laws and regulations in relation to land administration, and the land-use party shall pay vegetation restoration fee against relevant regulations of the State Council. Felling work shall be reduced, and restoration as well as compensation shall be made during and after the construction work. The investment for water-soil conservation in the project amounts to RMB686, 200 Yuan, and the investment for landscaped belt would be RMB100, 000 Yuan, while the investment for water treatment and ecological protection would total RMB845, 300 Yuan and, so the total investment for the environmental protection would be RMB1, 631, 500 Yuan. Through the foregoing protection measures, the impact by the project over environment and ecology would be reduced to the minimum without any obvious effect caused.

Conclusions & Recommendations

I. Appraisal Conclusions for the environmental quality around the Project

1) Air quality

The daily concentration of SO₂ (0.003mg/m³), NO₂ (0.008mg/m³) as well as inhalational particle (0.100 mg/m³) would all satisfy the Class I standard.

2) Water environment

The environmental quality in the maritime space under the jurisdiction of Xuwen County has been kept well, of which the water quality of seawater in various functional areas of the maritime space would meet the application requirement.

3) Acoustical environment

The environmental noises of project site at night and daytime are both less than 50dB, which is less than the Category 2 national standard.

II. Analysis of the environmental impact during project construction

1) Pollution factors during construction

Pollution factors like noise, flying dirt and waste water etc would be generated during wind turbine generator transportation, erection and supportive facilities construction, which, without proper treatment, would cause certain impact over the surrounding environment. Compared with situations in other similar construction sites, the impact for the Project over surroundings would be composed of the following parts:

(1) Noise

It includes mechanical noise of equipment and clashing noise during material loading & unloading, the sound level of which may reach 90dB (A).

(2) Flying dirt

It will be generated during the transportation, loading & unloading and processing of materials like brick, rock and cement etc.

(3) Waste water

It refers to construction site sewage with certain amount of mud during construction work, sewage containing grease from dinning hall and common sanitary sewage etc. Sewage discharged from dinning hall in the construction site may contain some residue and animal & vegetable oil, which may impact surrounding water body.

(4) Solid waste during construction

It includes residual mud, brick and discarded wood etc.

Solid waste would cause certain impact over the surroundings during construction, which shall be reduced and mitigated through strengthened management and civilized construction. Through limiting the work time of construction machine & equipment as well as management & treatment over solid waste and waste water, the said impact to the surroundings would be reduced to a lower

limit.

III. Appraisal of Environmental Impact upon Completion

1) Impact analysis over water environment

Waste water in the project would be mainly composed of sanitary sewage, the discharge amount of which was 6.5m³/d, and sanitary sewage, upon the deposition process in septic tank, will be gathered in the sanitary sewage adjustment pool set in the station, which will then be treated by integrated equipment upon meeting reclaimed water standard. After the process, water will be sent to draining pump pit for irrigation of landscape in the wind station. When water in the draining pump pit reaches to a certain level, then remained water will be discharged to drainage gutter out of the station. Sanitary sewage shall be treated and discharged upon meeting standard though the amount of sanitary sewage is not significant in the project, causing no obvious impact over water body.

2) Impact analysis over environmental air

Though flue gas will not be generated in the project, yet fume would still be produced from burning gas in kitchen for 14-staff food preparation, which will not generate obvious impact over air upon treatment by lampblack machine.

3) Impact analysis over sound environment

The project site is far from residential area and the noise caused by wind turbine generator would be less than 55dB (A) 200m away, imposing no obvious impact over the sound environment.

4) Impact analysis of solid waste

After being put into production, main generated solid waste would be domestic waste with the annual output as around 2t. Domestic waste shall be collected in designated place and then turned over to the environmental and personal health department for treatment and disposal periodically and uniformly. In addition, sterilization and pest-killing work shall be done for the stacking place of domestic waste to prevent the emission of niff and growing of mosquitoes and flies, which may impact the environmental sanitation nearby. Through the said measures, solid waste will be ensured not to cause adverse effect over the environment.

IV. Pollution prevention & treatment measures & advices during construction

1) Reduce construction work during nighttime (22:00 – 6:00) and, in case of requiring continuous construction at night, approval shall be obtained from relevant authority in advance.

2) For equipments with great noise and working points generating dirt, measures (construction time adjustment and water spraying etc) shall be taken to reduce the impact. Furthermore, fixed equipment causing significant noise shall be treated by ways like isolation, elimination and vibration reduction etc.

3) Covering and water-spraying method will be used to reduce the spread and pollution of dirt.

4) Vehicles transporting muddy residue and building materials shall be sheltered and then be cleaned before mobilization and demobilization.

5) Solid waste in the site shall be transported out and disposed of timely.

6) Construction unit shall, during every stage of the work, attach importance to afforestation, plant trees and grass, recover vegetation and prevent soil erosion during construction.

V. Conclusions

Upon Project completion, the wind power generation process will discharge no pollutant like waste water, flue gas or solid waste etc and thus free from several main cycles causing pollution by non-renewable resources power generation. In the project, there would be only small amount of pollutants like sanitary sewage, kitchen lampblack and domestic waste etc. However, during the installation of wind turbine generator, it would occupy land and damage vegetation, as well as generate flying dirt, noise and waste water; in addition, pollutants like sanitary sewage, kitchen lampblack and domestic waste etc would be discharged as well during construction; besides, the high tower upon completion would affect the scenery, and the operation of wind turbine generator would cause noise, the lubricating system of wind turbine generator; if the generator is improperly managed, it would affect the environment somehow and power transmission may also behave in the same way. With respect to factors affecting the environment during construction, Project owner shall, during and after the construction, carefully and earnestly comply with relevant environmental protection policies and measures, and take reasonable and effective measures to reduce any effect over the environment. Upon completion, the treatment of sanitary sewage shall comply with relevant requirements.

The construction unit shall during construction reduce excavation area and material stacking area, and shall try its best for every wind turbine generator to select tree-free ground, reducing the effect or imposing no effect over woodland and reducing the damage to vegetation; upon completion of the work, the construction unit shall clean the site and recover damaged vegetation during construction, reducing the impact over vegetation during construction and operation; in addition, the construction unit shall compensate for damaged woodland as per relevant rules. As long as the construction unit would reduce felling quantity, recover vegetation during and after construction and make compensation and relevant environmental protection measures, and then the impact over ecological environment would be minimized without obvious impact. Construction sewage shall be deposited to reduce suspended solid and sand content, and some may still be subject to recycling use. Reduce the use amount of clean water and discharging sewage outside; if it's necessary to discharge outside, destination shall be determined first.

Sanitary sewage produced during construction includes: grease-contained sewage from dining hall and common sanitary sewage. Since sewage from dinning hall may contain residue, animal oil and vegetable oil, which may impact water body nearby. It's recommended to construct a deposition tank near the residence of construction staff for simple treatment over sanitary sewage or for the treatment of sanitary water through Downward Permeability Method. Discharged sewage may be used to irrigate trees on mountain ridge. From these measures the impact over the environment would be minimized without apparent impact.

Once being put into production, sanitary sewage will be gathered in sanitary sewage adjustment pool upon deposit in septic tank, after which the same will be treated in integrated equipment and upon meeting the reclaimed water standard and discharged into draining pump pit for irrigating,

car washing and road washing. Though little in quantity, yet sanitary sewage shall be discharged after being treated, by which little impact would be caused to nearby water body. Fume from kitchen, if treated by lampblack machine and discharged, will impose no obvious effect over the environment. Sanitary sewage shall be collected and designated to the environment and personal health department for periodic and uniform treatment; in addition, sterilization and pest-killing work shall be done for the stacking place of domestic waste to prevent the emission of niff and growing of mosquitoes and flies, which may impact the environmental sanitation nearby.

Wind energy is a type of renewable, pollution-free, transportation-free and everlasting energy. It will make up the deficiency of non-recyclable energy resources, satisfy the need of ceaselessly growing economy and people's living demand, and reduce the emission of greenhouse gases as well as other hazardous gases (like SO₂ and nitrogen oxides etc) forming acid rain, releasing the greenhouse effect globally and protecting the environment where we live.

Upon being put into production, the output electricity would amount to 101, 384, 000KWh which, compared with thermal power station of equivalent scale, would save 35, 100t coal equivalent (equal to 49, 200t raw coal) every year, reducing the discharge of smoke and dust by around 215.8t, debris by 11, 000t, CO₂ by 76, 500t, CO by 9.33t, hydrocarbon by 3.71t and SO₂ by 679.4t. It can be seen that wind power generation would increase the output electricity without consuming non-recyclable resources, and would not involve exploration, transportation and burning fuels, so the possibility of environmental pollution generated in the process of each link can be avoided, bringing obvious environmental, economic and social effects. Once completed, it can be taken as scenery for tourism development, which would spread science, promote environmental protection and enhance the tourism economy development in addition to providing resources. The project, once completed, would provide pollution-free power, which would be beneficial to economic development and environmental protection, bringing positive function over the air and water environment. The project is feasible from the viewpoint of environmental protection.

Prequalification

Handler:

Official Stamp
MM DD YY

Review comments of environmental protection administration at the next level:

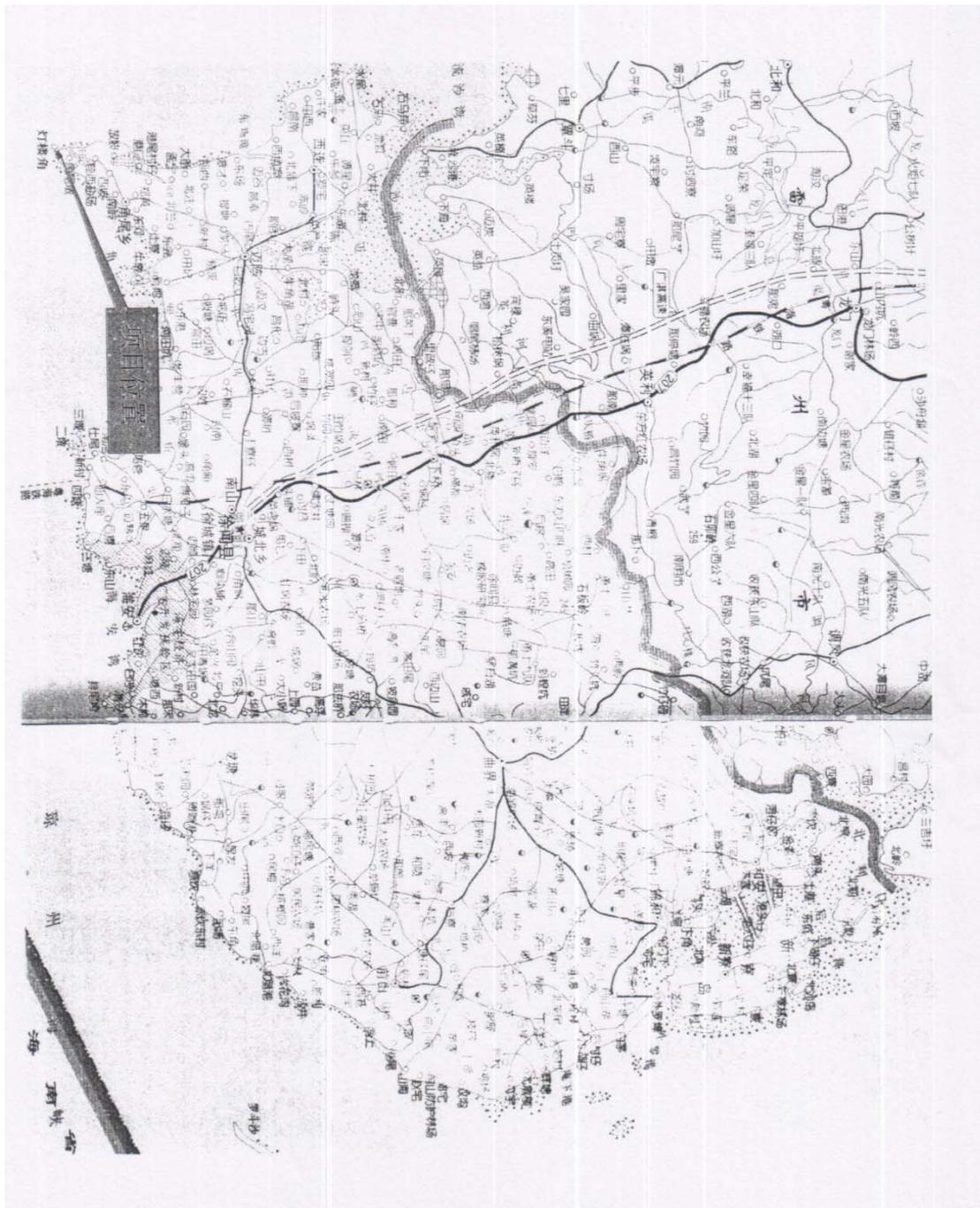
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Official Stamp
MM DD YY

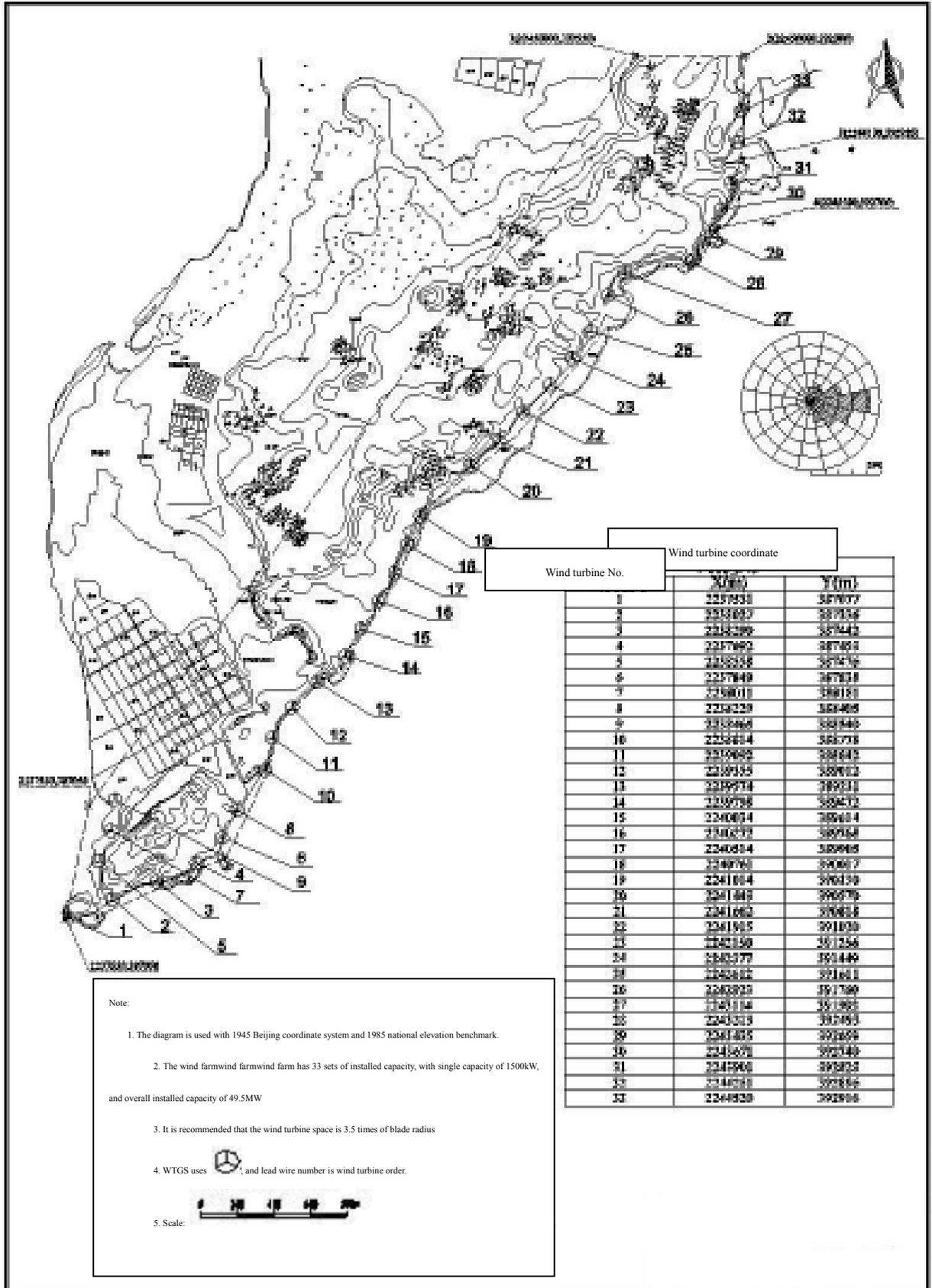
Approval comments:

Handler:

Official Stamp
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Attached Figure: Geological layout of the Project



Attached Figure2: Plane layout of the Project (subject to the approved design drawing)

Approval Registration for Environmental Protection of Construction Project

Company (seal): Prepared by (Signature): Project principal (Signature):

Construction project	Project name	Wind farm of Denglouliao, Jiaowei town, Xuwen county, Zhanjiang city, Guangdong province			Construction site	Jiaowei Village, Xuwen County, Zhanjiang City			
	Content & Scale	Overall installed capacity upon expansion as 49.5 MW, 33 sets of Wind turbine generator system with signal capacity of 1500kW			Construction nature	<input type="checkbox"/> new <input type="checkbox"/> modification and expansion <input type="checkbox"/> Technical transformation			
	Industry category	Wind resource power generation D-44			Management type of environment protection	<input type="checkbox"/> Report preparation <input type="checkbox"/> Report table preparation <input type="checkbox"/> Registration table			
	Total investment (RMB10, 000)	RMB500, 7856 Yuan			environment protection investment (ten thousand Yuan)	163.15	Proportion (%)	0.326	
	Determination Dept.	Guangdong Development & Reform Commission			Approval No.		Proposal time		
	Report approval Dept.	Environmental Protection Bureau of Guangdong Province			Approval No.		Approval time		
Owner	Name	Guangdong Yueneng (Group) CO., Ltd	Tel.:	20-38306128	Evaluation unit	Unit name	Climatic and Agrometeorological Center of Guangdong Province	Tel	87675773
	Address	Jiaowei Village, Xuwen County, Zhanjiang City	Postal Code	510075		Address	No. 6 Yard, Fujin Rd., Guangzhou City	Pose code	510080
	Legal representative	Lin Lihe	Contact	Yang yang		Certificate No.	No. 2804	Evaluation expense	
Environment status quo of the project site	Level of environmental quality	Environmental air: Surface water: Groundwater: Environmental noise: Seawater: Soil: Others:							
	Environment sensitive feature	<input type="checkbox"/> Drinking water source protection area <input type="checkbox"/> Nature reserve <input type="checkbox"/> Famous scenery <input type="checkbox"/> Forest park <input type="checkbox"/> Protective zone of basic farmland <input type="checkbox"/> Ecological function protection area <input type="checkbox"/> Key area for soil loss prevention <input type="checkbox"/> Ecological sensitive & vulnerable region <input type="checkbox"/> Population dense area <input type="checkbox"/> Historical and cultural relics under key protection <input type="checkbox"/> Huaihe River, Haihe River and Liaohe River; Taihu Lake, Chaohu Lake and Dianchi Lake; acid rain control zone & SO ₂ control zone <input type="checkbox"/> Three Gorges Reservoir Area							
a	Pollutant	Existing project (completed + in-process)			This Project (scheduled)			All Projects (completed + in-process + scheduled)	

Note: 1. * refers to pollutants subject to the overall discharge control by the country during 10th five-year plan.

2. Addition & reduction of discharge: (+) refers to addition, while (-) refers to reduction

3. Measurement unit: sewage discharge – 10, 000t/year; flue gas discharge – 10, 000 standard m³/year; industrial solid waste discharge: 10, 000t/year; water pollutant discharge concentration: mg/l; air pollutant discharge concentration: mg/m³; water pollutant discharge amount: t/year; air pollutant discharge amount: t/year;