

# Report Table of Construction Project Environmental Impact

(Trial implementation)

Project Title: Zhangjiang Yongshi Wind Farm Construction

Project by Guangdong Yuedian Group

Evaluation Unit (Seal): Scientific Research Institute of Pearl  
River Water Resources Protection

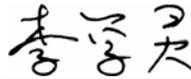
Date of compiling: Mar. 2008

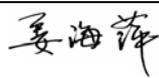
State Environmental Protection Bureau Compilation

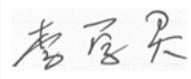
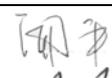
Project title: Zhangjiang Yongshi Wind Farm Construction Project  
by Guangdong Yuedian Group

File type: Environmental Impact Report Table

Evaluation unit: Scientific Research Institute of Pearl River Water  
Resources Protection

Legal representative: Li Xueling Signature: 

Project leader: Jiang Haiping Signature: 

Staff of environmental impact evaluation				
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Zhang Li	Professor level senior engineer	A28050017	Reviewed by	
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Zhou Xunhua	Engineer	A28050045	Compiler	

After inspection by state environmental protection environmental impact evaluation engineer occupational qualification registration management office, Jiang Haiping has the competence to engage in environmental impact evaluation and correlative operation, registration approved.

Occupational qualification certificate serial number: 0006822

Registration card number: A28050201600

Valid period: from Nov. 9, 2007 to Nov. 8, 2010

Local unit: Scientific Research Institute of Pearl River Water resources Protection

Registration category: Investigation of Check and Acceptance of Environmental Protection for Completion



Again registration records

Time	Valid period	Seal
	Extend to year month day	
	Extend to year month day	
	Extend to year month day	
	Extend to year month day	

State Environmental Protection Bureau Seal

Nov. 9, 2007



Full name: Jiang Haiping

Sex: Female

Date of birth: April 1966

Professional type: unavailable

Approval date: May 13, 2007

Issued by: Guangdong Province Personnel Office

Issued on: Aug 14, 2007



### Construction Project Basic situation

Project Name	Yongshi Wind Farm Engineering Project by Guangdong Yuedian Group				
Owner	Zhanjiang Wind Power Generating Co., Ltd under Guangdong Yuedian Group				
legal representative	Liu Luoshou	Contact	Xie Jun		
Correspondence address	Zhanjiang Municipality(County), Guangdong Province (Autonomous Region, Directly Governed City Region)				
Contact phone number	0759-3130362	Fax	0759-3130367		
Construction location	Xuwen County, Zhanjiang City, Guangdong Province				
Department of project establishment and examination for approval	Guangdong Provincial Development and Reform Commission	No. of Approval Document__			
Construction Nature	New	Industry Class and Code	Electric Power Production and Supply		
Floor space	538,500 m <sup>2</sup>	Afforestation area			
Total investment (10,000 Yuan)	51019	Wherein: Environmental protection investment (10,000 Yuan)	190	Proportion of environmental protection investment in total investment	0.37%
Evaluation fund(10,000Yuan)	7.33	Expected commissioning date	Dec 2008		
<p>Content and scale of project:</p> <p>I. Construction scale</p> <p>The Yongshi Wind Farm Project, sited in Xuwen County, Zhanjiang City, Guangdong Province (refer to Appendix 1 for its geographic location), has an altitude of 50~200m of the site height. According to the wind energy resource of the Yongshi Wind Farm of Zhanjiang, the project of this phase is designed with a scale of 49.5MW, and a wind turbine generator system (WTGS) consisting of 33 single turbine, each of which has an installed capacity of 1500kW. The annual generated electricity to access grid is about 116, 24 million kWh, and the installation utilization hours are 234h, implying 3.52 million kWh for every single unit and a capacity factor</p>					

of 0.268. The total investment into the project is 510.19 million Yuan, of which 494.81 million is static, of which, again, 417.24 million Yuan is for mechanical and electrical equipment and installation work investment, 40.06 million Yuan is for construction work, and 27.81 million Yuan for other costs, as well as 9.70 million Yuan is for the basic fund reserve, and the investments into engineering environmental protection and water-soil-conservation work are 1.90 million Yuan. The Wind Farm covers a total area of 47 km<sup>2</sup> and employs 20 workers for the project operation management.

## II Selection and layout plan for WTGS

The Wind Farm shall be installed with 33 units of WTGSs of 1500kW which share the model of MY1.5s-77 and the boss height of 70m. The project site is located in the Yongshi Farm in the middle of Xuwen County, enjoying a flat and open area where the wind turbines will be laid out alongside the roads of the farm. Refer to appendix 2 for the layout of WTGS.

## III. Electrics

### 1. Electrics phase 1

According to the *Access System Design for Yongshi Wind Farm of Xuwen, Zhanjiang*, the wind farm's 110kV step-up substation shall have 2 circuits of 110kV transmission line, both, 9km in length and 300mm<sup>2</sup> in cross section of the lines, are connected to the Yongshi Wind Farm's 110kV step-up substation, then connected through the 2-line substation access system into the 220kV Wentao Transformer Substation and 110kV Yongshi substation respective, 22km for the former and 6km for the latter, but 300mm<sup>2</sup> for the cross section. It's recommended for the connection method of the WTGS of this project to be 1 unit for 1 transformer cell. The WTGS, producing an output voltage of 0.69kV, shall be connected by low voltage cable to the box transformer substation where the voltage shall step up the to 35kV, then, by the 35kV collection line, to the 110kV step-up substation where the voltage shall for the second time step up to 110kV before ultimately reaching the Qujie Wind Farm's 110kV step-up substation.

### 2. Electrics phase 2

The control system of the wind farm is divided into two parts, namely the computerized monitor system of WTGS and that of the 110kV step-up substation; both share the control room of the 110kV step-up substation but work independently. **The WTGS monitor system is composed of a centralized control tier and a field single unit control system**, whereas the computerized monitor system of the 110kV step-up substation is comprised of a bay level and a substation control level, both of whose structures and functions are distributed by layers. The equipments of substation control level communicate information through an Ethernet to take care of the centralized monitor for the whole system, while the bay level will collect real-time information, monitor and control the operation of equipments of phase 1, as well as automatically coordinate and operate on the spot according to the operation requirements of the substation control level to ensure equipment safe operation.

## IV. Civil works

The civil works of this phase mainly includes the WTGS foundation, box transformer substation foundation, 110kV step-up substation and road.

### 1. WTGS foundation

According to the design parameters provided by the wind turbine manufacturer and the geological conditions of this site, it's proposed to adopt a solid right octagonal platform-type gravity found cast in place with C30 reinforced concrete having a distance between parallel edges of 16.8m at the bottom and 5.6 on the top, a maximum height of 2.8m and a minimum of 1.30m, and a depth of -2.5m.

### 2. Foundation of box transformer substation

It's proposed to adopt for the 35kV box transformer a natural foundation in the form of reinforced concrete cast in place.

### 3. 110kV Step-up transformer

The scale of the substation is planned with 110kV transmission line by 2, one of which shall be construction in this phase and the ground for the other will be preserved. The plane layout of the substation shall be subject to unified planning for the scale of 2 transmission lines to be constructed by phase. It's proposed to build the substation in the center of the site which has a high altitude, no big river so the substation will be not exposed to flood and inland inundation. The substation, to be in an ns-trending rectangular in the manner of outdoor open layout, dimensions 153m in length and 80m in width and covers an area about 12,251 m<sup>2</sup>. The buildings of this substation include the master control building, domestic building, 35kV high-voltage distribution room, storeroom, repair workshop, garage, and pump room and so on, totaling 2,613.9m<sup>2</sup>.

### 4. Road

The construction road to be built and rebuilt is 23.66km, which shall meet the need for foundation construction and once-for all equipment transportation. Mud crushed surface will be adopted for the construction road and, it's considered to rebuild the construction road with a designed width of 4.0m during the operation and overhaul period of the wind farm.

### V. Construction layout

It's preliminarily considered to draw a 10kv line from the Xuwen substation to the 10/0.38kV central transformer of the construction area, and from which draw lines to every construction power consumption points. In light of the wide distribution of the WTGS, it's also taken into account to equip a set of 120kW and 2 sets of 75kW mobile diesel generator. According to the overall schedule of construction, evenly around the step-up substation shall be the main construction facilities laid out, including the office and living area, construction warehouse, auxiliary processing workshop, concrete system, aggregate system, machinery service and general processing workshop, warehouse and temporary stacking ground for construction.

### VI. Permanent and construction temporary land use

*A total of 538,500 m<sup>2</sup> shall be used by the project, of which 177,400 m<sup>2</sup> is permanent and 361,100 m<sup>2</sup> is temporary.*

### VII. Overall schedule

The total working period of construction project is 12 months, please refer to Table 1 for project schedule.

Table 1 Project Construction Schedule

Item Name	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Construction preparation period												
Entry and construction road												
WTGS foundation construction												
110kV step-up substation and central control building work												
Laying of power and communication cable												
Hoisting of WTGS												
Commissioning												

VIII. Main work volume

The main work volume of this project includes: 33 units of WTGS, 33 sets of box transformer substation, a set of 110kV substation, 142,800 m<sup>3</sup> of excavation of earth-stone work, 126,400m<sup>3</sup> of backfill of earth-stone work, and 18,800 m<sup>3</sup> concrete.

Please refer to Table 2 for engineering characteristics

Table 2 Engineering characteristic

Name		Unit( or model)	Quantity	Remarks		
Wind farm site	Elevation		m	50 ~ 200	Average	
	Longitude (East)			110°14'~110°17'		
	Latitude (north)			20°29'~20°33'		
	Annual mean wind velocity		m/s	7.13	70m Height:	
	Wind power density		W/m <sup>2</sup>	285.0		
	Prevailing wind direction			ENE		
Main Equipment	Main electrical and mechanical equipments of wind farm	WTGS	Machine parameter	Set	33	
			Rated power	kW	1500	
			Blade number	Piece	3	
			Rotator diameter	m	77	
			Brushing area	m <sup>2</sup>	4700	
			Cut-in wind speed	m/s	3	
			Rated wind speed	m/s	11	
			Cut-out wind speed	m/s	25	
			Safety wind speed	m/s	70	3s (max)
			Boss height	m	70	
			Rotator revolving velocity	r/min	9.7~19.5	
			Generator capacity	kW	1500	
			Generator power factor		-0.95 ~ +0.95	
	Rated voltage:	V	690			
	electrical and mechanical equipment	35kV box transformer substation	Set	33		
	Step-up substation	Main transformer	Machine parameter	Set	1	
			Model		SFZ10-50000/115	
			Transformer capacity	MVA	50	
			Rated voltage:	kV	110±8×1.25% /35kV	
		Transmission line and voltage class	Transmission line number		1	
			Voltage class	kV	110	
	Civil construction	Wind turbine foundation	Machine parameter	Piece	33	
Form				Solid gravity foundation		
Ground base feature				Clay and decayed rock		
Box transformer foundation		Machine parameter	Set	33		
		Form		Reinforced Concrete slab foundation		

Construction	Work volume	Earth-stone work excavation		10,000 m <sup>3</sup>	14.28	
		Earth-stone work backfill		10,000 m <sup>3</sup>	12.64	
		Concrete		10,000 m <sup>3</sup>	1.88	
		Reinforcing steel bar		t	1561	
		Newly built road		km	18.2	
		rebuilt road		km	5.46	
	Construction period	Total working period		Month	12	
Power generation of the first WTGS		Month	8.5			
Investment index	Static investment (compilation year)			10,000 Yuan	49481	Oct, 2007
	Total project investment			10,000 Yuan	51019	Including working fund
	Static investment per kilowatt			Yuan/k W	9996	
	Investment per kilowatt			Yuan/k W	10307	
	Electromechanical equipments & installation			10,000 Yuan	41724	
	Construction works			10,000 Yuan	4006	
	Other expenses			10,000 Yuan	2781	
	Basic reserve fund			10,000 Yuan	970	
	Interest under construction period			10,000 Yuan	1538	
Construction	Installed capacity			MW	49	

Original pollution and main environmental issues related to the project:

The project construction is site in the Yongshi Farm, the middle area of Xuwen County of Zhanjiang. In this area there is no native vegetation and the current vegetation is mainly composed of cultivated eucalyptus, sugarcane, tea, pineapple and secondary herbal shrub. Pillared by agriculture economy overweighing industry, the air, noise and water pollution sources are few here and thus the air and noise quality is fine, also, there no large river flowing by the project area and groundwater provides the main water consumption of the residents here.

## Overview of natural environment and social environment of where

## the project is located

Overview of natural environment (Terrain, landform, geology, meteorology, hydrology, vegetation and ecological diversity):

### I. Terrain and landform

Located in south of Zhanjiang City, the southernmost part of China mainland, Xuwen County faces South Sea in the east, Northern Bay in the west and in the south Qiongzhou strait, which is 18 sea miles from Haikou City, Hainan Province. Xuwen County is the throat that connects Hainan island with mainland. Geological location of Xuwen County is approximately  $20^{\circ}15' \sim 20^{\circ}45'$  N.

Lat. and  $109^{\circ}50' \sim 110^{\circ}35'$  of east longitude. Its landform type is coastal terrace sand dune, height above sea level of which is below 30m. Its zonal soil is latosol and sandiness of surface soil, organic assay value of which is generally low, is evident.

### II. Geological and seismic overview

Located in southwest part of seismic belt of southeastern coastal zone in China, Zhanjiang City links to seismic-tectonic zone of Yunnan, Burma, Guangxi and Hainan. Geological structure in the zone is complicated and was severely active on the crust near geologic time. Deep and great fracture that has been discovered lays in Wuchuan-Sihui and Lianjiang-Xinxi in the northeast, Lianjiang-Yangjiang, Suixi, Nandu and Qiongzhou strait in the east and west, and Dongshan-Yatang and west coast of Leizhou peninsula in northwest, which incise and interfere one another. Southern part of the city formed into land at the end of the third Tertiary period, along with erection of 51 volcanoes, as statistics and documents show. At present, light earthquakes have frequently happened Leizhou peninsula and marine belt, and raising movement of the earth's crust is still continuing. Seismologically, a zone with a background of complete severe seism is existing. Ground fissure is growing in Leizhou peninsula, where 113 ground fissures are mainly distributed, according to statistics and documents. Recorded by Guangdong seismic station, a magnitude 6.1 earthquake happened in Northern Bay in 1994, with epicenter  $20.3^{\circ}$  at N. Lat. and  $109.5^{\circ}$  at east longitude; a magnitude 6.2 earthquake happened in Northern bay in 1995, with epicenter  $20.5^{\circ}$  at N. Lat. and  $109.4^{\circ}$  at east longitude. seismic intensities of urban districts of Zhanjiang, Leizhou and Xuwen County are mostly degree V. Near Jan 1<sup>st</sup>, 1995, a magnitude 6.1 earthquake and another with magnitude 6.2 happened in succession in the sea area of Northern bay, 45-50 km from coast of Xuwen Maichen, Qieshui and Jijia of Leizhou, followed by 5 magnitude 5.0 earthquakes and over 300 magnitude less than 4 earthquakes. According to China's Seismic Intensity Zoning Map (1999), seismic intensity of where the project is sited is zone, and peak acceleration is 0.10s.

### III. Engineering geological condition of the site

Located in Xuwen County, southeastern part of Leizhou peninsula in Guangdong, Yongshi Wind Farm with capacity of 49.5 MW is Leinan lava tableland, and located in the middle of Lei-Qiong faulted basin of South China fold in respect of zoning structure. Main fracture is northwestern and minor fracture is northwestern, forming into a web of structure. The fracture, which appears to lie concealed, formed and reactivated on the basis of previous Cenozoic structure. In late Cretaceous Period, the fracture was short and shallow and the crust was for one time in distention,

leading to diverse activities of fracture and forming a small faulted basin in the belt of Qianshan. In Cenozoic Era when the crust severely distended and sank, fracture reactivated and appeared to be in tensile downcut in various aspects, controlling formation of fault and fault uplift and basic volcano activities. No obvious mark of structure was revealed on the surface of the earth, crust of which was of mainly vertical fluctuating activities in modern times. Geological structure of the site and vicinities are in a stable zone.

#### IV. Meteorology

Lying in subtropical zone and featuring a obviously maritime monsoon climate, Xuwen is abundant in sunshine and without no frost but green all year round. Long-term annual average temperature in Xuwen is 23.6°C, extremely high temperature is 38.7°C, while extremely low temperature is 2.4°C. Average temperature in the warmest month July is 28.4°C, while that in the coldest month Jan is 16.4 °C. Its annual average evaporation capacity is 1,788.5mm, while annual average rainfall is 1,413.2mm; it is rainy season from April to September, with 80% of rainfall in the year. Therefore, draught is common natural disaster in the area.

#### V. Wind energy resources

There are considerable hillocks in the area of Xuwen, which is located in the southernmost part of Zhangjiang city in Guangdong province and where Yongshi Wind Farm is sited. In the area, northeaster prevails in winter season, while in summer southeaster is rife. Seasonal variation of wind speed is rather visible, characterizing that wind speed is greater in coastal land in the east while wind blows easier in inland areas in the west. Lying in hilly zone of Haiou Farm in Yongshi Town in Xuwen County, Yongshi Wind Farm is abundant in wind energy resources and certainly has promise in development.

Through statistical analysis on 35- year wind speed inspection documents by Xuwen Weather Station from 1973 to 2005, wind situation in the area where Xuwen Weather Station is located has the following characteristics:

##### 1. Wind direction

From analysis on documents by Xuwen Weather Station, we know that it is a control period of winter monsoon from November to February when northeaster mainly blows; it is a control period of summer monsoon from May to August when leaning south wind prevails on the earth surface; it is a transition season of the time from March to April and from September to October when convention of both warm and cold air current is obvious and wind direction is changeable.

##### 2. Wind speed

Through statistical analysis on 35- year wind speed inspection documents by Xuwen Weather Station from 1973 to 2007, long-term annual average wind speed is 2.79m/s, with a maximum annual average wind speed of 3.70m/s and a minimum annual average wind speed of 1.90m/s; long-term monthly average wind speed varies from 2.28m/s to 3.21m/s, where maximum value appears in the month of February and the minimum goes to August.

There are 4071#, 4079#, 40710# and 4091#, four wind measurement towers established near Yongshi Wind Farm. The 4071#WMT started to measure wind speed in Jan, 2007 and has been running well so far, recording data of wind speed for over one year. Rest of the three towers has served a relatively short period of time, starting to measure wind speed in Jan, 2008. The 4071#WMT was selected to be a representative tower in the wind farm through statistical analysis.

Annual average wind speed at 70m of 4071# WMT is 7.13m/s and wind power intensity is 285.0W/ m<sup>2</sup>; while annual average wind speed at 50m is 6.70m/s, and wind power intensity is 206.7W/ m<sup>2</sup>. Main wind direction and energy of 4071# WMT focuses on the three directions of E, ENE and NE. 48.3% is wind direction and 59.6% is energy; wind direction frequency reaches the

maximum in the direction of ENE, with a proportion of 19.87% and 23.97% of energy; wind speed is mainly distributed over a range of wind speed from 4m/s to 9m/s, with a proportion of 79.8%; wind energy covers a range of wind speed from 6m/s to 12m/s, with a proportion of 79.1%.

Annual air intensity of representative of wind farm is  $1.127\text{kg/m}^3$ , and hours of annual effective wind speed is 8179hrs, 93.9% of the year round.

Maximum wind speed at hub-height of 70m of wind turbine in 50 years can be calculated to be 41.9m/s, while extreme wind speed in 50 years is 58.7m/s. WTGs which is appropriate to □ wind situation of wind farm should be selected, according to safety phase □ of the wind farm, determined based on standards of International Electrotechnical Commission IEC61400-1(2005). Wind power of the wind farm is phase 2 according to Methodology of Wind Energy Resource Assessment for Wind Farm (GB/T18710-2002).

As it shows, the wind farm is abundant in wind energy resource and electricity from wind power is of high quality and qualification for grid-connected wind power generation, which certainly promises well.

#### VI. Overview of zonal vegetation

It is in the northern fringe of Torrid Zone, the climate in the area is tropical maritime monsoon and the type of zonal vegetation is tropical rain forest zone. However, the vegetation is presently economic plants and shrubs and brushwood, owing to disturbance and destruction of human activities, resulting in relatively low quality of ecological environment.

Social environment (social economic structure, education, culture, historical relics protection etc)

### I. Administrative divisions and population

Xu Wen County occupies an area of 1954.37 sqms in total, including Hai An economic development experimental area, 15 towns, 173 rural committees, 25 communities, 1246 villages and the street office of the people's government of county in Xuwen. The total population of the county in 2007 is 693,223, among others, including 75,075 people living in the city and 135,579 non-agricultural people. Labors in the first-industry, second-industry, and third-industry are 241,625, 5,153, and 18,792 respectively.

### II. Natural resources

#### 1. Land

Xu Wen county is abundant in soil with various types, including soil for rice, red soil seaside soil, overrid soil, soil for vegetables, Seaside Saline Swamp Soil and Seaside Saline Soil etc, and there are mainly red soil, soil for rice and seaside soil with an area of 2,317,600 Mu in total, which is approximately 87% of the total area of soil. The soil parent material is mainly Basalt rock, and then shallow sea sediment and seaside alluvial. Red soil is thick and fertile, with an average of 2.79% organic and 0.13% nitrogen. Yellow red soil is not only thick, porous and fertile, but also suitable for farming. The seaside soil is poor comparatively. The topography for the county tilts from the north to east, west and south, most of which is quite flat and with little gradient. Therefore, the soil can be highly used, and the soil varieties suit more usages which is conducive to the development of agricultural production.

#### 2. Marine resources

Xuwen County is surrounded by the sea in three sides, enjoying 372 km long coastline and numerous islands and harbors. There are more than 50 A Grade ports, mainly including ports like Hai'an, Wailuo, Xindi, Baoxi, Fenglongwan, etc. There are many fishing grounds, with the Qianhai fishing ground, Erka fishing ground, Shaojiao fishing ground, Hanguokou fishing ground, Waikatou fishing ground in the east, the Sitang fishing ground, Sandun fishing ground in the south, the Baoxi fishing ground, Waisha fishing ground in the west, the Beibuwan fishing ground in the north, and fishing grounds around the Hainan Island and Xisha Archipelago. The fish resources are very rich, mainly with yellow croakers, catfish, pomfret, Harengula Zunasi, West Daoyu, Parang fish and other economic fish. The county has wide and flat coastal shoreline, and the available aquaculture area is

195,000 mu, equivalent to 18% of cultivatable land. Inter-tidal area is 254,500 mu, of which 217,900 mu as mangrove. The available breeding area is 99,800 mu (10 m isobath has an area of 77,300 mu). As we can see, the County enjoys a unique position in the development of mariculture industry. Viewed from Xuwen county's marine economic development plan, the area in the northeastern part of the County in He'an, Jinhe, Xinliao and Xiayang has a vast ocean coastal area, with sufficient annual rainfall. As such, the flow area of the ground is vast, with a extensive mangrove cover, and the area is suitable to fish shrimp, crabs and mud cockles; in the south the coastal areas like Qianshan, Longtang, Hai'an, Nanshan, etc., the beach involves a lot of rocks. The sea water salinity and transparency show that they are suitable for breeding abalone and algae. In the west the coastal areas in Maichen, Jiaowei, and Xilian have flat shoal with seabed soil and fertilized in the soil. These areas are suitable for the growth of shellfish, sea cucumber, etc. The western sea beach also has adequate light, heat, with advantages of high salinity of sea water. Therefore, the area is conducive to salt production.

### 3. Mineral resources

The geological survey department on many occasions for exploration so far discovered in the County that there are a variety of minerals, mainly titanium zirconium, diatomite, iron ore and bauxite brown, and small amounts of quartz sand, Rail Link, magnetite, olivine, Steam, stone, ceramics and illite soil, and so on. Among them, the Titanium ore reserves are about 700,000 tons, involving an area of some 36 sq.km., mainly in the northeast to the southeast area in He'an, Xinliao, Jinhe, Qianshan, Longtang, and Xiayang, in the ocean along the coastal sand of them. Xiayang Town has the most abundant reserves. Diatomite reserves reach 100 million tons, covering an area of 9.26 sq.km and mainly in Yongshi Tianyang and Dahuang Jiumu. The Brown iron ore reserves are 19,400 tons, covering an area of about 74.5 sq.km. and mainly divided into Macheng mining area and Jiayang mining area. The Bauxite reserves are 8.97 tons, covering an area of about 25.3 sq.km, and mainly in the area of Yongshi, Xiaqiao, etc.

### 4. Water resources

Xuwen County has scarce water resource, unevenly distributed. The northern and eastern parts have the most abundant water resources, followed by the southern and then the western coastal area. The rainfall in the County is uneven, descending from the north to the southwest.

### III. National economy status

In 2007, the Zhanjiang municipal government under the correct leadership of the county people's congresses at county and the CPPCC's supervision and positive support, the County focused on "23678" goal, and actively implemented "people-oriented, scientific planning, industrial powerful county, agriculture enriching the people, the harmonious development" policy strategy, vigorously developed modern agriculture, agriculture & seafood processing industry, wind power industry, electronics industry, the logistics industry and tourism services. The national economy has maintained fast and favorable development, the cause of social progresses wholly, and the beginning of the various economic and social development goals and tasks has been well completed. Completion of the county's GDP was RMB75.368 billion Yuan, an increase of 13.1%, of which RMB72.518 billion Yuan added value of the first production, an increase of 5.6%; second stage of value added as 813 million Yuan, an increase of 22%; third-value added as RMB720.37 Billion Yuan, an increase of 18.9%. GDP per capita was RMB7,846 Yuan, an increase of 12.1% over the previous.

### IV. Cultural relics and scenic spots

No cultural relics and scenic spots are involved in the project.

### V. Environmental functional property of the project

The Local environmental function property of the project is provided in Table 3.

Table 3 The local environmental function property of the project

No.	Item	Type
1	Environmental air quality function area	Secondary Grade area
2	Sound environment quality function area	1 Grad area
3	Scenic spots reserved area	N/A
4	Zhanjiang City coastal ecological area	N/A
5	Reservoir area	N/A

## **Environmental quality position**

Environmental quality position of the local area of the project and major environmental problems (air, surface water, groundwater, sound environmental, ecological environment, etc.)

### **I. Investigation and evaluation on local environmental quality position**

The project will have no pollution upon the environment, nor will the operation of the project. Since the construction lasts only a short period and the scale is fairly small, the influences are limited. Therefore, the environmental quality evaluation will mainly be conducted in the collection of local environmental supervision and measurement information.

#### **1. Water environment**

The project is located in the middle of Xuwen County. The water resources are fairly poor and no major rivers flow through the area around the project site.

#### **2. Atmosphere quality position evaluation**

The evaluation mainly collects the normal supervision and evaluation data in June, 2006 in two places as collected by the Huajian residential committee of Xuwen County and the environmental protection bureau. Evaluations are made basing on this basis. The measuring factors are SO<sub>2</sub>, NO<sub>2</sub> and TSP. The details are provided in Table 4 and Table 5.

Table 4 Details on atmosphere quality position Unit: mg/m<sup>3</sup>

Time		SO <sub>2</sub>					NO <sub>2</sub>					TSP				
Month	Day	Value (Day mean concentration)	Grade II standard limit	Value exceeding	Rate exceeding	Times exceeding	Value (Day mean concentration)	Grade II standard limit	Value exceeding	Rate exceeding	Times exceeding	Value (Day mean concentration)	Grade II standard limit	Value exceeding	Rate exceeding	Times exceeding
6	2	0.007	0.15	0	0	0	0.015	0.08	0	0	0	0.136	0.3	0	0	0
6	9	0.008		0	0	0	0.012		0	0	0	0.135		0	0	0
6	16	0.002		0	0	0	0.013		0	0	0	0.074		0	0	0
6	23	0.003		0	0	0	0.011		0	0	0	0.062		0	0	0
6	30	0.005		0	0	0	0.015		0	0	0	0.053		0	0	0

Table 5 Details on atmosphere quality position Unit: mg/m<sup>3</sup>

Time		SO <sub>2</sub>					NO <sub>2</sub>					TSP				
Month	Day	Value (Day mean concentration)	Grade II standard limit	Value exceeding	Rate exceeding	Times exceeding	Value (Day mean concentration)	Grade II standard limit	Value exceeding	Rate exceeding	Times exceeding	Value (Day mean concentration)	Grade II standard limit	Value exceeding	Rate exceeding	Times exceeding
6	2	0.008	0.15	0	0	0	0.018	0.08	0	0	0	0.127	0.3	0	0	0
6	9	0.011		0	0	0	0.014		0	0	0	0.131		0	0	0
6	16	0.003		0	0	0	0.014		0	0	0	0.062		0	0	0
6	23	0.004		0	0	0	0.013		0	0	0	0.057		0	0	0
6	30	0.007		0	0	0	0.015		0	0	0	0.051		0	0	0

From the tables, we can see that both the day mean concentrations of SO<sub>2</sub>, NO<sub>2</sub> and TSP in the two places are lower than the Grade II standard limit. This shows that the atmosphere quality is favorable in Xuwen County.

## 2. Sound environment quality position evaluation

The results are collected from the data in the functional areas from June 2006. See Table 6 for details.

Table 6 Sound measuring results from the functional areas in June 2006, sound level Leq: dB(A)

Measuring place code	Functional area type	2:00	4:00	6:00	8:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00	24:00
1	1	43.2	53.5	51.2	54	55.5	53.7	53.3	53.7	54.5	52.2	50.6	44.2
2	2	45.7	44	54.1	58.1	60	56.2	57.5	57.6	58.8	57.7	51.2	48.7
3	3	48.6	49.4	56	59.2	63.5	60.3	61.2	63.5	62.3	60.5	56	52.9
4	4	54.7	54.5	58.9	66.6	67.3	67.3	66.5	69.1	70.1	67.3	56.9	54.8

Note: Measuring place: 1 – Xuwen Middle School; 2 - Traffic police station; 3 – Dashuiqiao Sugar Factory; 4 – two sides of the State Highway

From table 6, we can see that except for some hours in the functional areas of Xuwen County town, most of the hours the sound environment reaches corresponding standards. Since the project is located in Yongshi Farm area, sound resources are mainly of domestic noises. To conclude, the sound environment position within the area is fairly favorable.

Major environmental protection goals (list and protection levels):

#### I. Ambient air and sound environment

According onsite investigations, wind turbines for the Yongshi wind farm will be distributed in belt type along the roads at both sides within the farm, mainly in the area Yongshi farm 8-12 team. Environment air quality should conform to the Grade II standards as specified in “Environment Air Quality Standard” (GB3095—1996). The sound environment will conform to the Grade I standard as specified in “Urban Area Sound Environment Standard” (GB3096-93).

According the feasibility report, the wind turbines will be at places above 500m from residential areas. Therefore, during the construction period, no adverse influences will be exerted to the local residential communities in the aspect of atmosphere and sound.

Environment air and sound environment protection goal: no significant influences will be exerted on the local dwellers along the transit line. According to investigations, the team 12 and team 18 within the Yongshi farm are scattered in places within 40-100m along the transit line, thus they should be the key protection target of this project.

#### II. Ecological environment

The goal should be that no large area damage should be made to the terrestrial vegetation due to the construction of this project, and that farmlands should not be occupied in a large area due to this project.

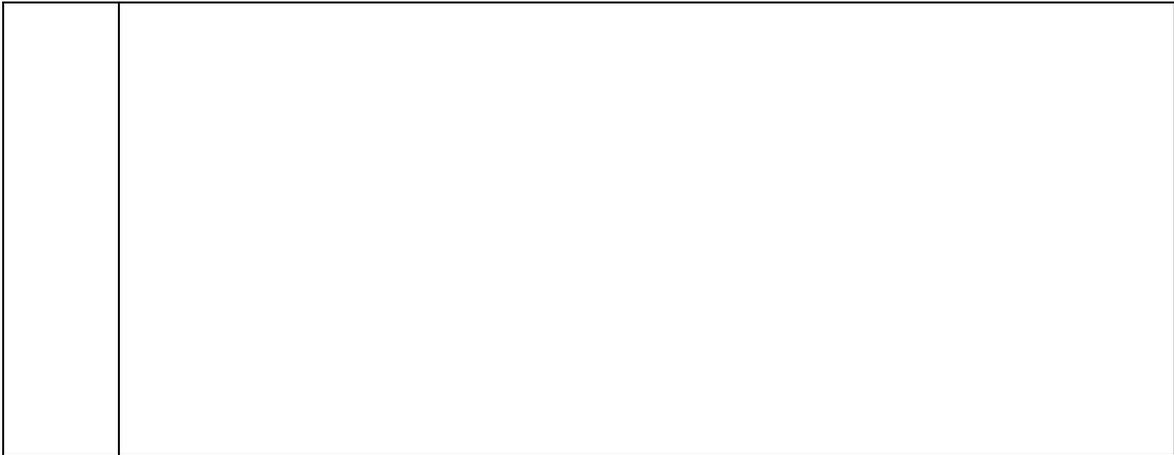
#### II. Water environment

There is no river involved in this project. The key protection target should be the groundwater.

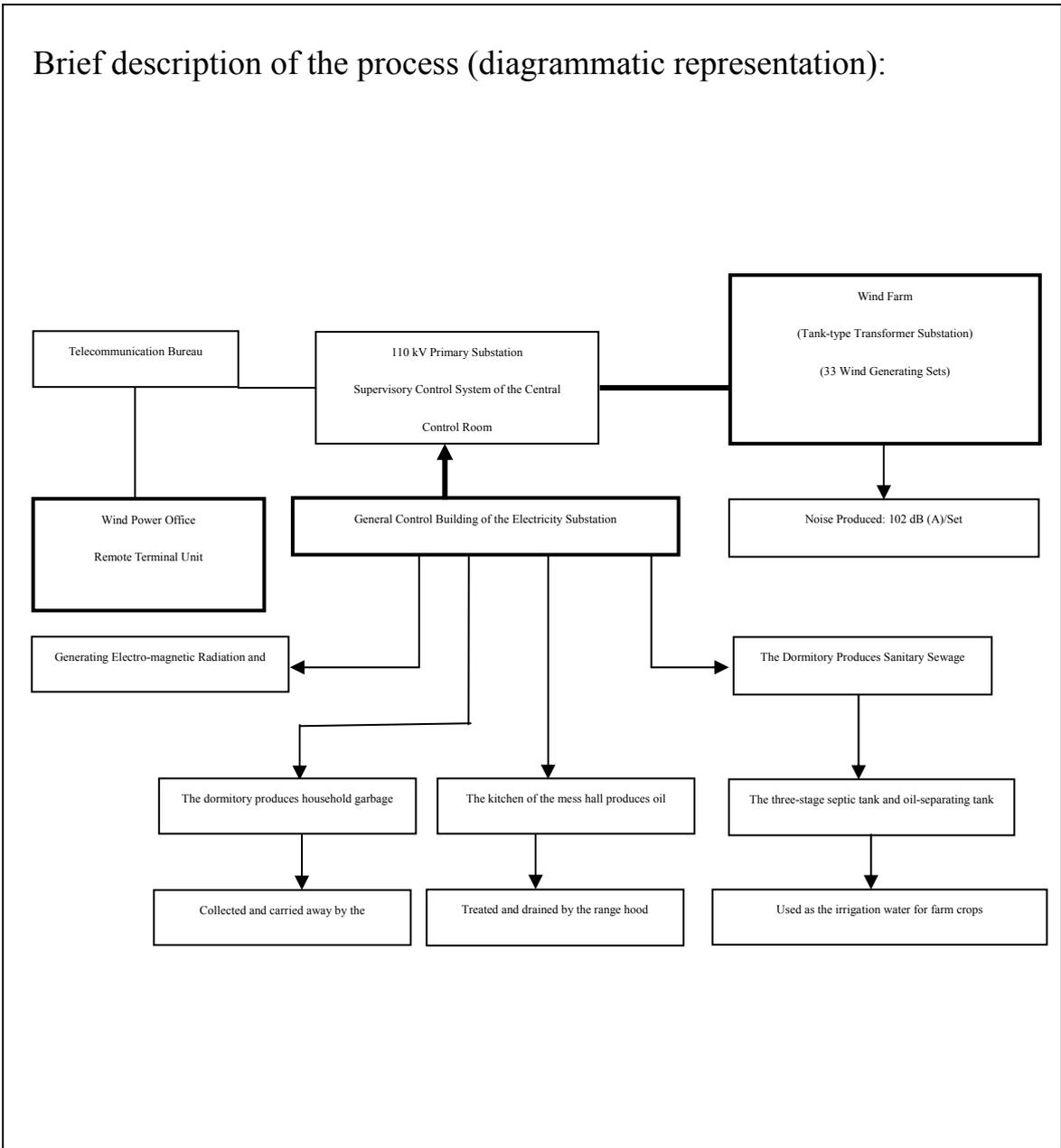
### Criterion of Acceptability of the Appraisal

<p>Envir onme ntal  Quali ty  Stand ards</p>	<p>1. “Regional Environmental Noise Standard for the Urban Area” (GB 3096—93) Rank 1 Standard. The controlling value in the daytime is 55dB; the controlling value at night is 45dB (A);</p> <p>2. “Quality Standard of Air Environment” (GB 3095—1996) Rank 2 Standard.</p>
<p>Efflu ent  Stand ard of Pollu tions</p>	<p>1. “Noise Limitation of the Construction Site” (GB 12523—90);</p> <p>2. Local Standard of Guangdong Province “Emission Limitation for Water Pollutant” (DB 44/26—2001) Rank 1 Standard (Second Period of Time);</p> <p>3. “Water Quality Standard for Farm Irrigation” (GB 5084-92);</p> <p>4. “Emission Standard for Oil Smoke of the Foodservice Industry” (GB 38483-2001);</p> <p>2. Local Standard of Guangdong Province “Emission Limitation for Atmospheric Pollutant” (DB 44/27-2001 ) Rank 2 Standard (Second Period of Time).</p>

<p>Contr ol Indic ator of the Total Amo unt</p>	<p>The effluent sewage of this project is primarily sanitary sewage which is produced by the managing staff of the wind farm. There would be 20 operating and managing staff during the operation period of Yongshi Wind Farm. If the emission of sanitary sewage is calculated as 0.15 m<sup>3</sup>/per person/per day, then the total volume of the sanitary sewage produced in the managing area would be 3.0 m<sup>3</sup> /d. This project will not distribute the control indicators of the total volume of the water pollutant for the reasons that: there is shortage of irrigation water on the project site; sanitary sewage produced during the operation period would not be emitted, rather, it would be used as irrigation water for farm crops after treatment.</p> <p>The control indicators of the total volume of atmospheric pollutant also will not be distributed for the reasons that: the project does not produce atmospheric pollutant itself during the operation period; the mess hall of the managing area is small in size and thus produces few oil smokes.</p>
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### Project Analysis of the Construction Project



### Major Polluting Processes:

This project will bring no pollutant and ecological influence to the environment. The influence of the project over the environment will mainly be in the construction period and there is litter influence during its operation period.

#### A. Construction Period

1. The eternal and temporary land occupations of the project will bring forth biomass losses to the vegetative covers and will have some influence over the land ecology. However, the vegetative covers within the construction scope are all local cultivated vegetative covers which can be commonly seen. The loss of them would cause no damages to rare

vegetative covers and the regional ecological integrity. For details, please go through the special topic for the appraisal of the ecological environment.

2. The noise and dust produced by the construction machineries and transportation vehicles during the construction period might have some impact to people who are living in the surrounding areas. However, these impacts will be temporary and can be alleviated or even avoided by adopting counter measures.

3. Wash-down water would be produced after purging construction machineries and transportation vehicles. There are 30 sets of various kinds of construction machineries and vehicles. If the volume of the wash-down water of every set is calculated as 0.3 m<sup>3</sup> /d, then the volume of the wash-down water produced in the construction area would be 9m<sup>3</sup> /d. The major pollutants of the wash-down water are SS and petroleum-type which may, after sedimentation and de-oil treatment, be used cyclically. This will not have an influence over the underground water environment.

4. The sandstone stuffs used in the project are qualified products directly purchased from the market. There will be no purging process in the construction site and for this reason, there will be no wash-down water of the sandstone stuffs; After finishing the work every day, the concrete mixer needs to be purged. This will produce small volume of wash-down water. Pollutants contained in the wash-down water are SS which may, after sedimentation process, be used cyclically. This will not have an influence over the water environment.

5. There will be 340 constructors in the peak time of the construction. If the volume of water discharged per capita is calculated as 0.15 m<sup>3</sup> /d, then the volume of sewage produced in the peak time of the construction area will be 51 m<sup>3</sup> /d. The daily sanitary sewage produced by constructors will, after being treated in the three-stage septic tank, be used as irrigation water for farm crops for the reason that the construction area is a water-deficient area. This will not have an influence over the environment.

6. After the balancing of cubic meter of earth and stone, the 164 thousand m<sup>3</sup> discard cubic meter of earth and stone will be used to backfill the nearby bottomland of the wind turbine. At the same time, preparation of land will be carried out and trees and grasses will be planted so as to avoid water loss and soil erosion. The household garbage of constructors could temporarily be stored in the garbage can and periodically delivered to local environmental sanitation authorities to be uniformly disposed. This will not have an influence over the environment.

## B. Operation Period

1. Sanitary sewage (including the oily sewage of the kitchen) produced by the managing staff of the electricity substation in the dormitory will, after being treated in the three-stage septic tank and oil-separating tank, be

used as the irrigation water for farm crops. This will by no means pollute the water environment;

2. The household garbage produced by the everyday life of the managing staff of the electricity substation shall be collected and treated by local environmental sanitary authorities. This can prevent the breeding of mosquitoes and flies as well as the polluting of the environment;

3. Oil smoke produced by the mess hall and kitchen of the electricity substation will, after being processed by the range hood, be emitted to the upper air. This will have no influence over the atmospheric environment;

4. Wind generating sets with the unit capacity of 1500 kW would be used by the wind farm and their annoyance value submitted by the manufacturer is 102 dB (A). According to site investigation, there is no residential point within the surrounding 500 m of the wind turbine, so there will be no noise effect.

5. Electro-magnetic radiation and noises produced by the electricity substation of the wind farm are mainly from electric appliances such as the voltage transformer, circuit breaker, electric current and voltage transformer, etc; The sources of noise are the main transformer and electric reactor. For details, please look at the special topic for electro-magnetic radiation.

## **The Generating of Key Pollutants of the Project and the Estimated**

### **Discharging Condition**

Content Type	Emission Source (No.)	Name of the	The Generating Concentration and the Generating Volume before the	Effluent Concentration and Discharging Volume (Unit)
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		Pollutant	Treatment (Unit)	
Atmospheric Pollution	The Mess Hall and Kitchen	Oil Smoke	13mg/m <sup>3</sup> 、 52g/h	2mg/m <sup>3</sup> 、 8g/h
Water Pollutant	Sanitary Sewage	CODcr BOD <sub>5</sub> SS Animal and Vegetable Oils	200 mg/L、 0.6kg/d 150 mg/L、 0.45kg/d 150mg/L 、 0.45kg/d 25 mg/L、 0.075kg/d	It could be used as irrigation water for farmlands and vegetable plots. In this way, zero discharge could be realized
Solid Waste	The Everyday Life of Residents	Household Garbage	1.0 kg/per capita·d	20kg/d

Noise	<p>The noise comes from the wind generating set equipments and the voltage transformer of the electricity substation. There are totally 33 sets and the noise value submitted by the manufacturer is 102dB (A); the voltage transformer adopts low-noise product and the noise level of the place 1.0 meter away from its hulk is no bigger than 70 dB (A).According to site investigation, there is no residential point in the surrounding area 500 meters within the sites of the wind turbine and transformer substation, so that no noise effect would be brought by the project construction.</p>
Others	
<p>Major ecological influences (additional pages could be attached when the space is not sufficient)</p> <p>(1) The eternal land occupation of the project will cause losses of biomass, have influence over the terricolous ecological environment and brings forth the problem of water loss and soil erosion;</p> <p>(2) The mishandling of cubic meter of stones and earthes generated by the construction of the project will cause water loss and soil erosion, and thus have an influence over the ecological environment;</p> <p>(3) The project will change the natural landscapes of local areas.</p> <p>For details, please look at the special topic for the appraisal of the ecological environment.</p>	

**Analysis of the Environmental Effect**

Brief analysis of the environmental influence of the construction period:

The Yongshi Wind Farm project is a new construction. The construction content of it mainly includes: the foundation excavation of the site for the wind generating sets, lifting and installing of equipment and site grading, etc; the foundation excavation of the site for the tank type transformer substation, equipment installation and site grading, etc; the construction of the 110 kV step-up substation; the construction and reconstruction of temporary roads, etc. Major factors which influence the environment during the construction period of the engineering construction are construction noises, mill dust, waste gas and waste water. The analysis of them are as follows:

#### A. Water Environment

The factory sewages during the construction period are mainly wash-down waters of the concrete mixing system, machineries and vehicles. The major pollutants of these waters include SS and petroleum type and, after the sedimentation and oil-removal treatment, can be used cyclically when they reach the rank 1 standard of the local standard of Guangdong province-----“Emission Limitation of Water Pollutant”.

The central part of Xuwen County, the location of Yongshi Wind Farm, is a water-deficient area. During the construction period, the sanitary sewage will not be emitted to outside places, rather, it will go through the treatment of the three-stage septic tank and, after reaching the dry farming

or vegetable irrigation water standards prescribed by “Water Quality Standard for Farming Irrigation”(GB 5084-92), be used as irrigation water for crops or vegetable plots.

In general, the zero draining of effluent sewage could be realized so that there will be no influence over the water environment of the construction area.

#### B. Ecological Environment

For details of the influence over the ecological environment, please look at the special topic for the appraisal of the ecological environment. The conclusion of the major appraisals is as follows:

The land occupation of the project is small so that the losses of biomass and amount of growth of plants caused by it will be small too. All the affected plants can be commonly seen in local areas. For this reason, the ecological function of this region will not be dramatically changed and the classification of vegetable forms will not be influenced. That is to say, the influence over the heterogenous degree of regional natural system will not be large. The project will not have a large influence over the diversity of living creatures in this region for the reasons that: The diversity indices of living creatures of all levels of the vegetative cover of the regions covered by the project is relatively small; the diversity indices of all kinds of Shannon -Weiner is relatively small. In general, the constructions of the project will not damage the ecological integrality of the construction site.

The newly-increased volume of loss of water and erosion of soils during the construction period of the projects is only 3285 t, a relatively small one. The land area of the long-term land occupation of the project is about 17.74 hm<sup>2</sup>, a relatively small one. This will not have a large impact on the regional land utilization.

### C. The noise effect of the construction period

Noises produced by the construction of this project could approximately be divided into two categories: stable and continual equipment noises of the construction machineries; flowing noises of communications and transportation.

#### 1. Mechanical noise

The source of mechanical noise could be deemed as fixed source for noise. The following simplified calculation formula could be used to estimate the weakening condition of the noise source:

$$L_p = L_{p_0} - 20 \lg ( r/r_0 )$$

In the formula :  $L_p$  ——The construction noise predicted value dB (A)  $r$  meters away from the sound source;

$L_{p_0}$  ——The reference sound level dB (A)  $r_0$  meters away from the reference range of the sound source;

$R$  is the distance between the measuring point and sound source. Unit: m.

By using the above formula, we can work out the noise predicted

value of different distances while various kinds of construction machineries are working. The result is shown on table 7.

Table 7: the noise predicted value of the stationary source of the construction area in different distances Unit: dB (A)

<b>Type of Machinery</b>	<b>15m</b>	<b>50 m</b>	<b>90 m</b>	<b>130 m</b>
Excavator	83.0	72.5	67.4	64.2
Push Dozer	85.0	74.5	69.4	66.2
Blending Machine	81.0	70.5	65.4	62.2
Thrust Borer	77.5	67.0	61.9	58.7
Wheel Loader	80.5	70.0	64.9	61.7

Under the conditions of not considering noise superimposing, we can figure out the followings from the table: all the construction noise values 90 meters within the construction machineries exceed 60 dB (A) and the residential points of villages and town which are near the road construction area would be influenced; the noise values of all the construction machineries 130 meters within the sound source exceed 50 dB (A). If the construction is carried out at night, then the residential points of villages and towns which are near the road construction area and within 130 meters of the sound source would be influenced. In view of the fact that all of the distances between the construction area of this project and residential

points are over 500 meters, the noises of construction machineries will therefore have no impact on the lives of residents.

## 2. The influence brought by traffic noises

The noise values of relevant vehicles are based on the noise data of different kinds of motor vehicles with different kinds of speeds (California, U.S) in a place 15 meters away from the center line of the road. See the following table 8:

Table 8: The noise value of different kinds of vehicles with different kinds of speeds Unit: dB (A)

Type of Vehicle (One)	Speed Range ( km/h )					The Decibels Added When the Speed is Doubled
	32 – 47	48 – 63	64 – 79	80 – 95	96 – 110	
Heavy Truck (Loading)		78	81	85		9
Heavy Truck (Empty)		75	78	81	84	9

Medium-sized Truck	69	70				
Light Truck	66	69				9
Omnibus				81	84	9
Motorcycle		73	79	81	86	12
Car		64	67	72	73	8.5

After entering the construction site, fully-laden heavy trucks would be driven at a speed less than 20km/h and the noise value 15 meters away from the vehicle would be about 60dB (A) according to the calculation of table 8. The range of influence of heavy trucks is shown on table 9 according to the calculation of the formula.

Table 9: The predicted value of noises of fully-laden heavy trucks in different distances Unit: dB (A)

<b>Distance (M)</b>	15	40	50	70	90	130
<b>Noise Value</b>	60	51.5	49.5	46.6	44.4	41.2

Site trial shows that people of the twelfth crew of Yongshi Farm live in both sides of the motorway which leads to the wind farm. The distances between them and the motorway are 40 m ~ 100m. According to the estimated result, we may learn that transportation vehicles will not have influence over the people of the twelfth crew in daytime. However, certain

degree of overproof will appear at night. So it is suggested that the construction time should be reasonably arranged and construction works at night should be prohibited.

#### IV. Influence by atmospheric environment

##### 1. Dust and aflutter dust

Since construction period of this project is short and involved scope is narrow, and the air scattering conditions are good, and the air is humid, which could reduce the influence of dust to some degree. But along with the dig of earthwork, unloading and transportation, a lot of dust may be produced during construction. Comparing with supervision materials of similar projects, area with 100m nearby may be influenced. Since there is no residential points in the area 500 far from the wind turbines and transformer substation, so there will be no noise. During transportation, reasonable controlling measures shall be adopted to reduce the pollution and reduce the affected area.

## 2. Wasted air

During construction, wasted air mainly comes from the construction machinery and vehicles as well as fuel used by construction teams in daily life. The main pollutants discharged are NO<sub>x</sub>, CO and hydrocarbon. Since the construction site is open with good air scattering conditions, the wasted air produced will not affect the surrounding environment greatly.

## V. Influence of solid waste

The abandoned earthwork of the project will be backfilled in the billabong near WTGs, and vegetation shall be resumed so as to not affect the environment. In the rush hour of construction, there will about 340 construction personnel. The life garbage will be 340kg/d, which will be placed in ashbin temporarily and delivered to local environment and sanitary department for unified dispose and the surrounding environment will not be affected.

## VI. The influence on human health by construction

In the construction area, the human density is big and sanitary conditions are weak in life area. The lack of management may result in the epidemic disease in the construction area. So we should pay high attention to it.

According to construction experience of similar project in China and

foreign countries, as long as we pay attention to the sanitary epidemic prevention, regular medical examination of construction personnel and disinfection of houses, immediate treatment of state of illness, collection, treatment and management on life sewage and garbage, the epidemic disease can be prevented.

Analysis on influence of environment in operation period:

Wind electricity is clear energy. In the operation period, the project itself will not affect the air, water and zoology environment, or produce lot of solid waster. The analysis on influence of environment is as follows:

#### I. Water environment influence

Project sewage comes from daily life sewage of managerial personnel. Since wind electricity has higher automatic operation level, the wind farm only has 20 operational and managerial personnel. Calculating by  $0.15\text{m}^3$  of life sewage for each person per day, the total amount of managerial area will be  $3.0\text{m}^3/\text{d}$ . After meeting the dry farming or vegetation irrigation standards of *Water Quality Standard of Farm Irrigation* ( GB5084-92 ) through treatment, life sewage will be used as dry farm and vegetation

irrigation water, and will not affect the zone water environment.

## II. Ecological environment

During operation period, following the growth of vegetation resumed, the biomass lost during construction will be compensated gradually; and since the WTGs are arranged along the two sides of roads with order, plus the vegetation, a new landscape line is formed, which improved the surrounding sight. Yongshi Wind Farm installs 33 sets of 1500kW WTGs with small rotation of 9.7 ~ 19.5 rotation/min, and the spacing of WTGs is over 500m. According to migrant bird protection zone of Xuwen County, Yongshi Wind Farm does not belong to migrant bird protection zone; and after asking local specialists from forest department, construction site of this project does not belong to the migrant passage of migrant birds. So, in accordance with the characters of project construction and combining with above scientific investigation results and the influence on migrant birds by wind farms already built in China, this wind farm will not affect the migrant birds. See ecological environment appraisal subject for details.

## III. Voice environment influence

Yongshi Wind Farm adopts 33 sets of WTGs with single capacity of 1500kW. The noise value of hub of single wind turbine supplied by factory is 102dB(A). Calculating by noise attenuation mode, the noise value is reduced to 15dB in the 200m far from wind turbine, which met the night

noise standard of project construction site; transformer substation adopts low noise transformer, and the noise level at 1.0m far from its cover will not exceed 70dB(A). After 20m attenuation, the noise will be reduced to 44 dB(A), meeting the night noise standard of project construction site. Since there are no residential points in the area 500 far from the wind turbines and transformer substation, so the project will cause noise affection to residents.

#### IV. Analysis on environment air influence

The exhaust gas of this project comes from the lampblack of kitchen in the dining room, which can be treated by static lampblack removing machine and discharged after meeting *Lampblack Discharge Standard for Catering Services* ( GB38483-2001 ) , not affecting the air in surrounding environment.

#### V. Influence by solid waste

The solid waste produced by daily operation of this project is mainly life garbage. There are 20 operational and managerial personnel. Calculating by 1.0 kg/d each person, the total garbage produce each day is 20kg/d. The life garbage will be delivered to local sanitary department for unified dispose.

## VI. Analysis on influence of electromagnetic radiation

Electromagnetic radiation measured by comparison meets power frequency tension limit 4000V/m (recommended value) of *500kV Extra Voltage Transmission Electromagnetic Radiation Influence Appraisal Technical Code* (HJ/T24-1998), that is the requirements on 0.1mT (recommended value) of magnetic field tension. See influence of electromagnetic radiation for details.



**Prevention measurements adopted by construction project and predicted curing effects**

Contents Type	Polluted source (No.)	Name of pollutants	Prevention measuremen ts	Predicted curing effects
Air pollutant s	Kitchen in dining room	Lampblack	Static lampblack	meeting <i>Lampblack Discharge Standard for Catering Services</i> ( GB38483-2001 )

Water sewage	Life sewage	COD <sub>Cr</sub> BOD <sub>5</sub> COD <sub>Cr</sub> SS Animal and plant oil	after 3-level cesspool treatment, it is used for crop irrigation water	Realize zero discharge
Solid waste	Daily life of managerial personnel	Life garbage	local sanitary department for unified dispose.	Will not affect surrounding residential points
Noise	After calculating, the noise produced by WTGs is reduced to 45dB(A) in the 200m far from wind turbine, and noise produced by transformer substation will be reduced to 44dB in 20m, which met the night noise standard of project construction site; since there are no residential points in the area 500 far from the wind turbines and transformer substation, so the project will cause noise affection to residents.			
Others				

## Ecological protection measurements and predicted results

(1) Resume vegetation in wind farm. After erecting wind turbines, conduct vegetation cover with grass slope surrounding the foundation. The selected grass includes Taiwan grass, carpet grass, creeping dayflower, centipede grass, etc. And some ornamental flower or foliage plants shall be placed in the grass like sun flower, marigold, red mulberry, floral leaf banyan and floral leaf lotus, etc. Thus, the biomass lost can be compensated and the environment is beautified, building the environment for future theme sightseeing tourism.

(2) Along the sides of enlarged roads, greening shall be completed to prevent water and soil loss and improve landscape. The selection of trees shall show tropical feature, so palmaceous plants like coconut, royal palm, Bangalow Palm, betel palm, *Ravenea rivularis*, oil palm and *Carvota urens*, as well as *Kigelia Africana* and *Aphanamixis grandifolia*. For temporarily built roads, original land usage type shall be resumed so as to reduce the loss of agricultural land.

(3) In the wasted residue farm, billabong shall be backfilled and vegetation shall be resumed to prevent the water and soil loss.

See ecological environment appraisal topic for detailed contents.

## **Environmental effect**

With the total installed capacity as 49.5MW, the Wind Farm would provide 116.24 million kWh clean power energy for the power grid which, compared with thermal power plant and calculated by the substituted standard coal of 330g/kWh, the Farm would save standard coal around 38,300t every year, which is equal to 53,700t raw coal. By the calculation, the project would reduce the emission of various air pollutants, around 736t SO<sub>2</sub>, 9.97t CO, 4.16t CnHm, 418t NO<sub>2</sub> and 91,100t CO<sub>2</sub>; in addition, it can reduce the emission of lime-ash as about 11,800t. What's more, the construction of the Wind Farm would also increase the scenic value of Yongshi Farm and boost the development of local tourism, drive the development of local tertiary industry and improve the local economy development. Therefore, the construction of the Wind Farm would not only bring considerable economic benefit but can also bring obvious social effect and environmental effect.

## **Conclusion and recommendation:**

## I. Conclusion for evaluation of environmental quality status quo

The evaluation for the environmental quality status quo is performed based upon the environmental monitoring data collected. According to the result of usual monitoring, the environmental status quo in place where the Project is located is sound, and the quality of air and noise in which would meet standard requirement. The area where the project is located lacks of water since no river runs by the area.

## II. Environmental impact evaluation during construction and pollution prevention & treatment measures

### 1. Conclusion for the evaluation of environmental during construction

As an ecological-system pollution-free Project, the environmental impact exposed during the work mainly exists in construction period. The conclusion for the environmental impact evaluation during construction period is as follows: earthwork excavation, construction and occupying site etc and the storage of discarded debris etc would damage the vegetation and cause the loss of biomass; however, the loss would be minor and lost biomass would be common local economic crops, which would not damage the integrity of the regional ecological system; since the construction work will occupy little area at site, so it will not change the local land use pattern; limited earthwork excavation at site during work will cause limited soil erosion as well; waste water generated during construction will mainly come from batch plant system and the flushing of construction machines

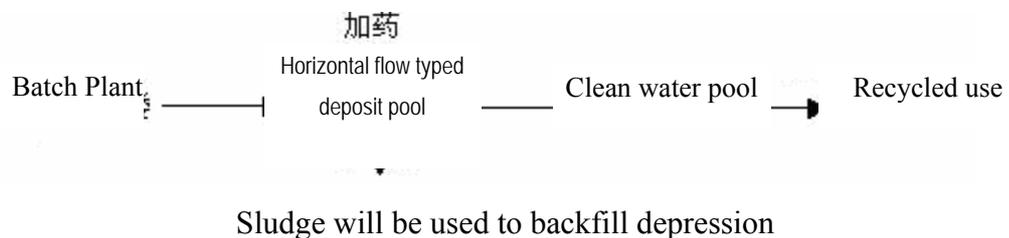
and transportation vehicles which can be recycled after treatment due to the small amount, so it will not cause impact to the environment; since the area lacks of water, so domestic waste water will be used for irrigating crops after treatment in cesspool; lampblack in kitchen will not cause impact to the environment by treating with smoke exhauster; residential communities around the site is 500m apart, so the construction will not cause air or noise impact to the communities. Transportation vehicles may bring some impact upon partial residents in 12th team and 18th team in the Farm, which would be reduced to acceptable range by measures adopted.

## 2. Pollution control measures during construction

### (1) Control measures for water pollution:

Waste water incurred during construction mainly includes flushing-used waste water and domestic waste water.

Waste water from batch plant flushing will be recycled through settlement and flocculation. The detailed process is as follows:



Oil-polluted waste water from flushing construction machines and transportation vehicles include main pollutants like SS and oil, which may

be recycled through settlement and oil-removal process, the detailed process is shown as follows:



Domestic waste water will be used for crop irrigation after three-level cesspool treatment.

## (2) Measures for ecological system protection

Construction progress shall be strictly controlled and the excavation work shall be avoided during rainy days; housekeeping shall be kept during construction, and random excavation, storage and hardening ground will be prohibited to reduce the damage to the ground and vegetation and protect water-soil resources; clean off sealed off surface soil, store in place uniformly suitable for protection and maintain temporary protection; reduce temporary storage and unnecessary transfer transportation for excavated soil, and use them directly for backfill; clean off construction debris after construction, level the ground and never discard anything at random. Provisional simple discharge groove shall be set around the construction area during the work of foundations for wind turbine generator, substation and administrative building etc, set up fence and excavate drainage ditch around temporary ash storage yard to prevent water-soil erosion. After the work completion, plant grass and plant near wind turbine generator base, within and around substations.

### (3) Control measures for noise pollution

Strengthen the management during construction, select low-noise equipment, arrange construction time reasonably (high-noise construction work at night is prohibited) and provide labor protection measures to reduce the environmental impact by noise during construction. Transportation vehicles shall slow down and shall not whistle when passing by the 12th team and 18th team of Yongshi Farm.

### (4) Control measures for air pollution

Carry out scientific management over the construction site: store sand materials in an uniform place and store cement in specific warehouse; reduce handling of material and ensure to lift and place anything lightly in case of breaking packaging bags; spray water for working surface prior to excavation and dismantling to keep certain humidity; avoid the overload of transportation vehicles and cover or seal off vehicles during transit to reduce on-the-way spillage; stop construction work in windy days. Clean off and make use of debris during construction in case of causing flying dirt by long-term storage.

### (5) Disposal measures for solid waste

Discarded soil, construction debris and dried sludge etc shall be backfilled and leveled near the depression around wind turbine generators timely, while domestic waste will be sent to place designated by local environmental & sanitation agency for uniform treatment.

## II. Environmental impact evaluation during operation and pollution prevention & treatment measures

### 1. Conclusion for environmental impact evaluation during operation

As an ecological-system pollution-free Project, the Project will cause little impact upon the environment during operation. The detailed evaluation is as follows: the noise caused by wind turbine generator and substation will not cause impact upon residents since no resident is within the 500m range of turbine generator and substation; power frequency electric field and the power frequency magnetic field generated during substation operation caused impact to surrounding residential communities far less than the standard value and will not lead to electromagnetic radiation to surrounding residents; domestic waste water will be used for crops irrigation after cesspool treatment, and daily domestic waste will be collectively stored and sent for treatment by local environment & sanitation agency, so they will not cause any impact; lampblack in kitchen will not cause impact to the environment by treating with smoke exhauster.

### 2. Pollution control measures during operation

Three-level cesspool will be constructed to ensure all domestic waste water would be treated in cesspool and sent to irrigate crops regularly; in the meantime, cesspool will be regularly cleaned off to ensure the effect of treatment. Domestic waste will be sent for treatment by local environment

& sanitation agency; lampblack in kitchen be treated by smoke exhauster.

#### IV. Comprehensive conclusion

1. As a type of clean energy, wind power will not emit any harmful gas during the generation operation, so it's regarded as one of the power supplies with the best environmental effect and the new energy encouraged and supported by our country for sustainable development. After completion, it will provide sufficient power and add new scenes for local tourism, yet it will not cause pressure upon the environment. Therefore, the Project would have obvious social effect and environmental benefits upon completion.

2. Environmental impact caused by the Project would mainly be during construction, which would include noise, dirt, waste gas and waste water etc, yet these adverse impacts would be temporary and can be controlled or removed by pollution prevention and treatment measures and will be dispelled with the completion of the work.

3. The electromagnetic radiation by the Farm will be minor. Mainly coming from substation, electromagnetic radiation can be effectively solved by proper shielding measures and necessary protection for working staff.

4, The Project is provided with the obvious energy-saving and emission-reduction function.

5. As the conclusion, the Project would be feasible in terms of socioeconomic issue and environmental protection concern.

Pre-examination comments:

Official Seal

Principal:

MM

DD

YY

Review comments by the environmental protection administrative body of  
the lower level:

Official Seal

Principal:

MM

DD

YY

Comments for examination and Approval:

Official Seal

Principal:

MM

DD

YY

## **Appendix I :**

# **Engineering Project of Zhanjiang Yongshi Wind Farm by Guangdong Yuedian Group Special Issue on Assessment of Ecological Environment**

## **1 Natural environment profile**

Located in south of Zhanjiang City Guangdong Province, the south most of China, bounded by South China Sea to the east, North Bay to the west, separated by Qiongzhou Strait to the south and 18 sea miles away from Haikou City Hainan Province, Xuwen County is the fortress connecting mainland with Hainan Island with geographic position of 20°15'- 20°45' north latitude and 109°50'- 110°35' east longitude. Geomorphic type in Xuwen County belongs to coastal platform barchans, where the height above sea level is below 30m, regional soil is lateritic red soil, surface soil is of sand obviously and with lower content of organic matter.

Climate type in construction site is tropical monsoon climate, outstandingly featured in marine and is rich in temperature, light and water resource; mean annual temperature there since several years is 23.6°C and mean temperature in the hottest month (July) is 28.4°C; mean annual rainfall is 1413.2mm but unevenly distributed, from April to September per year is rainy season, when quantity of precipitation is more than 80% of the whole year's, and rains there are mainly typhoon rain, while mean annual evapotranspiration is 1788.5mm. Therefore, dry is the common natural disaster in this area.

## **2 Identification of impacts upon ecological environment**

The impacts exerted by this engineering construction and operation upon ecological environment can be summarized based on engineering analysis and status quo investigation of surrounding environment of engineering area from these aspects as below:

(1) Engineering permanent land covering and temporary land covering will leads to loss of vegetation biomass and will exert some impact upon terrestrial ecosystem. Based on the material provided by property owner, engineering permanent covered land includes foundation of wind turbine generator system, foundation of box transformer substation, cable laying, 110kV booster transformed substation and etc, amounting to about 17.74hm<sup>2</sup> in total; engineering temporary covered land includes lifting site, temporary building, centralized concrete mixing plant and other covered lands, amounting to 36.11hm<sup>2</sup>. From these, this engineering only destroys small surface area and brings limited biomass loss; besides, the wind turbines are distributed in both road sides in spot in the farm and therefore can not lead to change to the centralized mode in farm and type of making use of large land area.

(2) It is necessary to excavate earth and stone for wind turbine generator system foundation, foundation construction of transformer substation and cable laying of this engineering, and therefore improper handling of temporary piling and disused soil will lead water and soil runoff.

(3) Production waster water during construction period should be recycled after being treated; domestic sewage during construction period and operation period could be used for irrigation after being treated and will not pollute surrounding ecological environment.

(4) Wind turbine generator system should be layout along both sides of country road in the farm and therefore forms a new landscape strip. Even though new landscape will exert some influence upon original natural environmental landscape, landscape coordination will not interfere with each other obviously; by contrast, add a new kind of regional feature defining against surrounding environment and become a special new landscape manifesting the harmony between human being and nature.

Based on the analysis of identification of impact upon ecological environment, the objectives mainly influenced by this engineering is loss of land vegetation and water and soil runoff caused by it.

## 3 Status quo assessment on quality of ecological environment

### ***3.1 Status quo assessment on quality of land ecological environment***

#### **3.1.1 Methods of investigation and assessment**

In consideration of smaller area influenced by engineering and simpler type of vegetation, investigation on land area of this engineering mainly depends on line investigation, and hortus variety mainly depends on the records of investigation with assistance of relative reference material; vegetation investigation is carried forward through combining line investigation and typical investigation, i.e. to carry forward sample land investigation by selecting typical land section based on investigation of overall line. Among which sampling area of arborous layer is 10m×10m, sampling area of shrub layer is 5m×5m, sampling area of herb layer is 1m×1m, ; record the specific name, height of tree (plant height of shrub and herb), diameter breast height (base diameter of shrub), crown diameter (covering of shrub and herb) and other indexes, make the statistic upon the frequency and number of trees, calculate importance value, growth, specific diversification in accordance with relative formula, and determine the type of community and distribution. Key calculation formula is as below:

$$IV = RA + RF + RD$$

In which, *IV* is importance value, *RA* is comparative density (i.e. the proportion of some plant's density to total densities), *RF* is comparative frequency (i.e. the proportion of some frequency to total frequency of all plants), *RD* is comparative degree of dominance (i.e. the proportion of some diameter breast height section in total to all diameter breast height section in total or the proportion of some crown diameter plant in total to all crown diameter plant in total).

Calculation formula of biological quantity and production volume generally adopts the suggested methods of *Analysis and Comprehensive on Quality of Hainan Island Ecological Quality*:

Measurement formula of arborous biological quantity is:

$$Bmf = 0.00003396D^2H$$

In which, *Bmf* is the biological quantity of forest community (t· dry weight), *D* is diameter breast height (cm), *H* is height of tree (m).

Measurement formula for production volume (growth quantity) of woody-layer is:

$$Bg = 0.000010246 ( D^2H )^{0.625}$$

In which,  $Bg$  is production volume (growth quantity) (t),  $D$  is diameter breast height (cm),  $H$  is height of tree (m).

Sampling harvesty method could be adopted for biomass calculation of shrub layer.

Measurement formula for the index of biodiversity (Shannon-Wiener diversity index):

$$SW = 3.3219 ( \lg N - \frac{1}{N} \sum_{i=1}^s n_i \lg n_i )$$

In which,  $SW$  is Shannon-Wiener diversity index,  $N$  is total individual number in sampling area,  $n_i$  is individual number of the  $i$ -th plant, and  $s$  is number of species.

### 3.1.2 Status quo of land ecological environment

#### 3.1.2.1 Status quo of hortus resources

Engineering impact area locates in Yongshi Farm in the center of Xuwen County, the plant in which is quite simple, mainly including artificially planted *Eucalyptus* spp, *Camellia sinensis*, *Saccharum officinarum* L, *Musa sapientum*, *Ananas comosus*, *Casuarina equisetifolia*, *Cocos nucifera*, *Melia azedarach*, *Aphanamixis grandifolia*, *Acacia auriculaeformis*, and etc; planted fruit trees include coconut, *Lithi chinensis*, *Mangifera indica*, *Psidium guajava* and etc; the species naturally distributed include *Hibiscus tiliaceus*, *Macaranga tanarius*, *Jatropha curcas*, *Celtis tetrandraroxb. ssp. Sinensis*, *Ficus microcarpa*, *Ficus altissima*, *Carallia brachiata* and etc; the species of shrubs commonly include *Pandanus tectorius*, *Litsea glutinosa*, *Lantana camara*, *Sageretia thea*, *Mimosa sepiaria*, *Psychotria rubra*, *Strophanthus divaricatus*, *Atalantia buxifolia*, *Rapanea linearis*, *Polyalthia plagioneura*, *Desmos chinensis*, *Dodonaea viscosa*, *Arytera littoralis*, *Solanum torvum*, *Atropa belladonna* and etc; hurb plants mainly include *Zoysia matrella*, *Imperata cylindrical*, *Eremochloa ciliaris*, *Eragrostis perlaxa*, *Chrysopogon aciculatus*, *Sporobolus virginicus*, *oenothera bienni*, *Wedelia prostrate*, *Launaca sarmentosa*, *Spinifex littoreus*, *Common Achyranthes Herb Herba Achyranthis Asperae* and etc; climbing plants mainly include *Ipomoea pes-caprae*, *Embelia laeta*, *Mussaenda pubescens* Ait., *Vitex trifolia* Linn. var. *simplicifolia* and etc.

### 3.1.2.2 Status quo of vegetation resources

#### 1. Regional vegetation profile

This region borders with tropic zone to north, where the climate belongs to tropical zone maritime climate, regional vegetation is tropic rainforest. However, no original vegetation exists in this region due to inference and destruction of human being activity. Most of the vegetation at present is artificially planted economic crops or secondary herbal shrub.

#### 2. Types of main vegetation within the scope of engineering

Based on line investigation, main vegetation within the scope of engineering has 5 types, i.e. eucalyptus forest, tea wood, sugarcane, ananas comosus (L.) and banana. On-site picture sees attachment diagram for reference.

##### ( 1 ) Eucalyptus forest

It belongs to artificial forest, generally includes eucalyptus urophylla and clone of eucalyptus and is distributed in strip on both road sides of Yongshi Farm. Height of tree is generally 10-15m; plantation density is usually 2m×2m, diameter breast height is 5-15m. Eucalyptus is often planted through deep tillage work, and has little vegetation under the tree; more or less you will see eupatorium catarium, sida queensland hemp and bidens bipinnata L. under it.

##### ( 2 ) Tea wood

This kind of vegetation is mainly distributed in the location of Team 18 substation of Yongshi Farm, with an area of 2hm<sup>2</sup>. Tea tree is perennial evergreen woody plant and can be classified as arbor, sub-arbor and shrub in accordance with trunk. Tea tree in this region belongs to shrub and the height of vegetation is about 0.5m.

##### ( 3 ) Sugarcane

This kind of vegetation is widely distributed in Yongshi Farm. Sugarcane is annual ratoon tropical and sub-tropical herb plant and is C4 crop, with vertical stalk, juicy and strong, white powder on surface, alternate leaf, tiny and sharp tooth on leaf edge. Its flower cluster belongs to compound raceme, plant height is 1.5-2.5m and diameter breast height is 4cm.

##### ( 4 ) Ananas comosus (L.)

This vegetation is also one of main economic crops commonly distributed in Yongshi Farm. It is also called pineapple, pineapple family, pineapple genus, and is perennial monocotyledonous herb plant and perennial monocotyledonous evergreen fruit tree. It grows in low, the height of plant is 0.5-1m, no main root and has fiber fibrous root system; the succulent stem is enwrapped by the leaves growing in helix, and the leaf is in the shape of a sword; terminal inflorescence, growing with several small flowers; several germens polymerized in floral axis constitute the

succulent stem.

( 2 ) Banana

This kind of vegetation is distributed on both sides of the road between Yongshi team 9-10. Banana is mostly perennial evergreen large-size herb monocotyledonous plant, no main root. The leaf is in long circular, bright green. The spike inflorescence is drooping. Infructescence is made of 7-8 sections and even several tens of sections of fruit bunch. The fruit is in color of yellow green, in long circular, bent slightly, has three edges and is planted with no seed. Plant height is about 2-3m, and proportion of covering is 80%.

3.1.2.3 Biomass, growth quantity and biodiversity index

1. Biomass and growth quantity

Biomass and growth quantity is the key index to evaluate if an ecological system function is good or not. Biomass refers to the total weightiness of dry matter of all present live organic matter in community during special period, while production volume refers to organic matter volume produced by the organism in community through photosynthesis and combining with solar energy. Based on foresaid measurement method, calculate the biomass and growth quantity of different vegetation in this region. The result sees table 3-1 for reference.

Table 3-1 The characteristic of productivity of vegetation at district of the project

No.	Type of vegetation	Biomass ( t/hm <sup>2</sup> )	Net production volume ( t/ hm <sup>2</sup> ·a )
( 1 )	Eucalyptus forest	32.5	10.2
( 2 )	Tea wood	10.2	6.5
( 3 )	Sugarcane	35	16.9
( 4 )	Ananas comosus (L.)	13.4	15.7
( 5 )	Banana	18	15.1

2. Biodiversity index

Biodiversity is a key index reflecting the structure complexity and stability of the community and the higher of biodiversity is directly linked with successional stage of the community and the degree of artificial interference. Generally, the community with higher biodiversity has larger

stability; therefore, the higher biodiversity is also an important index to reflect environment quality.

Because the vegetation in the region involved in this engineering is mainly artificial vegetation or secondary herbal shrub, the community of which has lower biodiversity, seen from the diversity analysis upon plant community of this region, Shannon-Weiner diversity index of each type is lower between 0.73-1.51, and greatly less than 4.12-4.84 of typical lower subtropical monsoon evergreen broad-leaved forest and fully mirrors the secondary nature of each vegetation type.

### **3.1.3 Evaluation on ecologic environment quality**

#### **3.1.3.1 Standard for assessment**

The Biomass and production output of green plants are the foundation for the material and energy circulation of ecologic system, they are the most important characteristic and essential sign of ecologic system. Consequently the present assessment adopts the biomass and production output of plants as the indices for assessment of terraneous ecologic system.

##### ( 1 ) Net production output of plants

The net production output of plants is the residual output by total amount of organic substance generated by photosynthesis minus the output consumed by the respiration of plants. The net production output of plants is directly relative to plants' ability of maintaining balance between carbon and oxygen in the air and of purifying pollutants, therefore the net production output of plants is closely related to the regional ecologic environment. According to present research regarding zonal vegetation, namely the south subtropical evergreen broadleaf forest, its net production output is approximately 25t/ hm<sup>2</sup>·a at maximum, therefore we adopt this value as the highest level of net production output and as the rated production output, we also divide the net production output into 6 levels (see table 3-2 for details), the ratio between production at each level to the rated output is the rated relative net production output.

$$P_a = P_i / P_{\max}$$

$P_a$  - The rated relative production output;

$P_i$  - The net production output, t/ hm<sup>2</sup>·a;

$P_{\max}$  - The rated net production output, t/ hm<sup>2</sup>·a.

Table 3-2 The net production output and the rated relative net production output of vegetation at all levels in south subtropical zone of Guangdong.

Level	Net production ( t/ hm <sup>2</sup> ·a )	Rated relative net production output ( t/ hm <sup>2</sup> ·a )
I	≥25	≥1.00
II	25-20	1.00-0.80
III	20-15	0.80-0.60
IV	15-10	0.60-0.40
Va	10-5	0.40-0.20
Vb	< 5	< 0.20

( 2 ) Biomass and the rated relative Biomass of plants

The biomass of south subtropical primitive vegetation in Guangdong is relatively homogeneous while the change in biomass of existing vegetation is rather great. The maximal value of biomass for zonal vegetation, namely the south subtropical evergreen broadleaf forest is at present approximately 400 according to research. The current assessment adopts this value as the highest level of plant biomass and the rated biomass, we also divide the plant biomass into 6 levels (see table 3-3 for details), the ratio between biomass at each level and the rated biomass is the rated relative biomass.

Table3-3 The biomass and the rated relative biomass of vegetation at all levels in south subtropical zone in Guangdong

Level	Biomass ( t/ hm <sup>2</sup> )	Rated relative biomass ( t/ hm <sup>2</sup> )
I	≥400	≥1.00
II	400-300	1.00-0.75
III	300-200	0.75-0.50
IV	200-100	0.50-0.25
Va	100-40	0.25-0.10



Environment impact report of Zhanjiang Yongshi wind farm by Guangdong Yuedian Group  
Special subject of environment assessment

						area			
Zhanjiang	1688461	746912	164121	471954		2028057		38230	544013.
	4.4	1.4	0.2	2	4645.1	.1	95724.1	1	5
Chikan District	88258.1	15697.6	423.8	55925	0	46138	1678.5	718.4	18009.3
Xiasha District	131443.8	38282.2	286.0	20240.3	15.4	61631.4	5551.9	761.2	4675.4
Potou District	584167.7	242438	16101.9	181453.	331.1	107132.	3732.8	3590.	29386.6
				8		7		8	
Mazhang District	727019	385175.	70645	208288.	699.8	185949.	8144.3	18486	37630.3
		7		1		3		.5	
Suixi County	2849655.	151482	46779.1	866961.	289.7	367294.	17135.1	26301	10068.3
	3	5.8		6		4		.3	
Xuwen County	2411393.	101344	644114.	298546.	254.5	266168.	12663.1	59493	116711.
	6	1.7	5	3		7		.3	5
Lianjiang City	3927924.	142491	371899.	151761	531.3	370706.	18259	17020	53797.8
	6	2.8	4	7.1		2		1	
Leizhou City	4760920.	227862	476649.	131217	34.8	461650.	20042	9443.	202302.
	6	5.6	6	2.5		5		3	3
Wuchuan City	1136671.	555722	14310.9	308667.	2488.5	171385.	8517.4	8325.	67253.7
	4			8		9		2	

The characteristics of land resources in Zhanjiang are as following:

- ( 1 ) The land consists of vast mesa plain, is surrounded by sea on three sides and has a large area of shoal.

The terrain of Zhanjiang is high in the north and low in the south, with many hills in the north, the highest point of the land is on the ShuangfengZhang of Lianjiang City with an elevation 382m above sea level, the rest of

the terrain is mesa and plain 30 to 80m high above sea level. Hills and mountainous area make up 34% while mesa and plain make up 66% of the total area, therefore the land is easy to develop; Zhanjiang city is surrounded by sea on three sides and the five counties(Cities) and four districts under its jurisdiction are adjacent to sea, the city has a coastline of 1555.7 km long, a shallow sea area of 5064.63km<sup>2</sup> at 10m isobath, in which the shoal area is 990.82km<sup>2</sup>. The superior land resources of Zhanjiang are favorable for the development of ocean economy, industrial and agricultural production, tourism industry and urban construction.

( 2 ) High rate of land usage and land cultivation

The land usage rate of Zhanjiang amounts to 86.72% while the unutilized land accounts for 13.28% of total land area, most of the unutilized land are land plots such like raised path through fields and so on with the exception of shoal. The land cultivation rate reaches 38.08% which is 24.68% higher than that of Guangdong province, on the other hand, the area of irrigated field only accounts for 40.34% and the per capita crop field area is small.

Xuwen County is surrounded by sea on three sides and has a continuous long coastline; the terrain within the region is flat with some low hills while there are many islands along its coastal area. The county is mainly featured by tilth, garden land and woodland. The center of Xuwen County is located in the south and the land for townspeople construction is mainly distributed along the sea. The said project is situated in the middle of Xuwen County and the land that it involves is mainly agricultural land.

## 4 Forecast and assessment on impact on ecologic environment

### *4.1 Evaluation of the impact on terraneous ecologic environment*

#### **4.1.1 Forecast of the impact on ecologic environment during construction period**

##### **4.1.1.1 Loss in biomass and change in productivity due to vegetation damage**

The surface area of original physiognomy affected by said project is approximately 53.9 hm<sup>2</sup>, the main vegetation in area occupied by the project consists of Eucalyptus spp, Camellia sinensis, Saccharum officinarum L, Musa sapientum and Ananas comosus. Loss in plant life caused by project construction is approximately 1385.07t and the loss in net growth is 743.5 t./a according to estimation. Please see table 4-1 for the loss in biomass and net production output.

Table 4-1 the loss in vegetation growth caused by major sections under construction during construction period

Vegetation type	Area	Loss in biomass (t)	Loss in net production output t/a
Eucalyptus spp forest	17.5	568.75	178.5
Camellia sinensis forest	2.4	24.48	15.6
Saccharum officinarum L	14.8	518	250.12
Ananas comosus	15.6	209.04	244.92
Musa sapientum	3.6	64.8	54.36
Total	53.9	1385.07	743.5

#### 4.1.1.2 Change in heterogeneity degree of damaged vegetation

The heterogeneity refers to the time-based or space-based variation degree of a certain region's ecologic system resource (or a certain characteristic) which has deciding effect on the existence of a certain specie or life community. Since that the various constituents of ecologic system have different ecologic niches, they form a complex, subtle and reciprocal relation for plants and animals' habitation, migration, and resistance against internal and external interruptions. Therefore the change in heterogeneity is also an important question to be considered in the assessment of non-pollution ecologic impact of the said project.

The construction area of the said project is located in Xuwen county of Zhanjiang City, the affected area is not large which only accounts for an extremely small part of the forestial land of Xuwen county, hence no important impact will be caused to the whole forest area of Xuwen county, The loss in biomass and vegetation growth caused by the project is minor when compared to the forest conservation volume and forest growth in the whole Xuwen county.

The above analysis indicates that the most of vegetation coverage and of vegetation types within the region are not changed, in other word, the constituents having controlling effect on the ecologic environment of the region are not changed and there isn't major change in the heterogeneity of ecologic environment. In addition, the affected vegetation types are mainly the most common vegetation types in the locality, especially that the *Casuarina equisetifolia* is the main artificial vegetation of costal area in Zhanjiang City, consequently the said project will not

cause great change to the ecologic function of current region nor to the vegetation classification, this mean that no major impact will be caused to the heterogeneity degree of regional nature system.

#### **4.1.2 Evaluation on delicate ecologic issue**

##### **4.1.2.1 Condition regarding damage in biodiversity**

The biodiversity indices at all levels of vegetation types within the affected region are rather low, the Shannon-Weiner biodiversity index for various vegetation types are rather small ranging from 0.73 to 1.51, while that of the arbor synusia of coniferous and broadleaf mixed forest within the same region normally ranges from 1.96 ~ 2.86, and that of typical evergreen broadleaf forest is around 4.00, in conclusion, the vegetation diversity index of the affected region is relatively low. As indicated by the analysis of constituent types of plants in the region, most of the plants are common species and there is no ecologically sensitive specie, therefore the said project will not cause great impact to the biodiversity of the region involved.

##### **4.1.2.2 Loss in rare and endangered species**

According to route examination and typical investigation, no protected specie of plants are found in the region affected by said project and all plants that found are common species in current region, therefore the project will not cause harm to rare and endangered plants in the region.

##### **4.1.3 Impact on ecologic environment during the operational period**

The project will not cause immense impact to ecologic environment after completed and become operational, only that the noise generated when wind turbine is functioning might cause a certain impact to adjacent residents, it is known according to project planning that wind turbines are rather far from residential area, in addition, normally the straight distance between wind turbines and residential area is more than 500m, therefore it will not greatly affect residents. In respect of vegetation ecology, the greenization on land occupied by project will also help to alleviate project's negative impact on vegetation.

## ***4.2 Forecast on loss in amount of water and soil***

The newly increased amount caused by project can be calculated by following equation:

$$\square WS1 = \sum [N \times Fi (Mi - M0)]$$

Where:

$\square WS1$ —The newly increased loss amount in water and soil after the original physiognomy is affected ( t ) ;

$Fi$ —The area of different land types affected ( km<sup>2</sup> ) ;

$Mi$ —The physiognomy erosion rate after affected ( t/km<sup>2</sup>.a ) ;

$M0$ —The original physiognomy erosion rate of the region before affected ( t/km<sup>2</sup>.a ) ;

$N$ —The fixed number of year for the forecast ( a ) .

The physiognomy in affected region is similar, 6.6 thousand t/km<sup>2</sup>.a is adopted as the value for the average physiognomy erosion rate during construction period according to comparison with the physiognomy erosion of similar projects, 0.5 thousand t/km<sup>2</sup>.a is adopted as the value for original physiognomy erosion rate, viewing that the construction period is one year, we can obtain the newly increased loss amount in water and soil during construction period which is 3284.85t, as it shows, the loss amount is rather small.

## ***4.3 Impact on land utilization caused by land occupation of project***

The Yongshi wind farm requires a permanent land occupation of 17.74 hm<sup>2</sup> . The permanent land occupation and temporary land requisition are mainly for the purpose of disposing wind power generation units, case-type substation, electric cable, 110kV substation, temporary facilities for production and living, temporary road for construction and so on.

The types of land occupied by project might include woodland, tilth, orchard, economic forest, natural grassland and fish pounds. The occupation of woodland and grassland by project will lower the green coverage in Zhanjiang City and is not favorable for the development of urban Greenization system in Zhanjiang; the occupation of tilth and orchard by the project will lower the production of grains, vegetables and fruits; the occupation of aquatic product breeding area and

economic forest area will lower to a certain extent local farmers' income from breeding and other income.

Generally speaking, Zhanjiang City possesses woodland area of 52381.3hm<sup>2</sup>, agricultural land area of 83869.2hm<sup>2</sup> and aquatic product breeding water area of 45146.8hm<sup>2</sup>. The land occupation of said project only accounts for an extremely small part of total area; therefore its impact is basically negligible. Nonetheless, according to the principle of balanced land utilization and for protection of local residents' benefits, it is recommended to conduct vegetation recovery for woodland and tilth temporarily occupied by the project during construction, and to compensate affected residents appropriately for their loss; it is required to exploit a land of corresponding area for land permanently occupied by the project as a compensation for original land types, to maintain a basically balanced green land area, grain production and so on; it is also supposed to grant economic compensation to affected residents. With all the above done, there will be no great effect caused to the locality.

#### ***4.4 Impact analysis on landscape***

The construction of Yongshi wind farm changes original land use type, however the wind farm contains less land and is laid out in the form of point-line along the roads in the farm; and the farm also becomes another landscape except protection forest ("Green wall") through the improvement of surrounding vegetation which will form new green belt after being grown. All these will beauty urban environment and form landscape layout, even though some vegetation is destroyed. This farm is also developed as a new tour sight spot for people, as a harmonious and uniform landscape between human beings and environment. From this point, the impact on landscape from the construction will be less.

#### ***4.5 Impact analysis on migratory bird***

##### **4.5.1 Section division in Xuwen migratory bird reservation zone**

Xuwen County locates in southmost of China Mainland, and belongs to tropic and semi-tropical monsoon climate, surrounded by three seas, with long coastline, many sea birds, thick coastal protection forest, rich species, as well as many ingredients; this is the main place

for stopover, propagation and winter for migration of migratory birds all over the world. Based on statistics, more than 120 types of birds in Xuwen, where migratory bird is up to 40 types. The period from September to April in next year is the annual migratory bird period.

Xuwen migratory bird reservation zone is established in November 2001, in terms of the approval in accordance with Xufu[2001]No108 *Notice of issuing section division of migratory bird reservation zone in Xuwen County*. The reservation zone will be divided into the followings according to the distribution of Xuwen natural resources and migratory bird action:

( 1 ) Protection forest in 4km wide of all coastal village and town along the sea in Xuwen

( 2 ) All island and large and middle scale reservoir districts in Xuwen

( 3 ) Mangrove wetland area

( 4 ) Key protection area by 2km protection forest in Jiaowei, Xinliao island, Luosha island in Qianshan Town, Dongsong island and Beili island in He'an Town, Sandun island in Wuli, reservoir district in Dashuiqiao as well as coastal area.

#### **4.5.2 Impact analysis on migratory bird by wind farm**

The impact on migratory bird by wind farm will be analyzed in the form of comparison with existing scientific research achievements and practical operation of built wind farm in China

( 1 ) Relevant scientific research achievements of impact on migratory bird by wind farm

□ Survey purpose

For the purpose of taking relevant compensatory measures to the impact from wind farm operation, the scientists have perform relative survey on local birds impacted by Misselwarden wind farm in Germany in 1994-1999. The purpose of this survey is to obtain specific situations of impact on migratory bird from wind turbine, in order to provide more reliable assessment for future project plan.

This wind farm is completed in June 1994 and put into operation. The erected hub-high of 10 sets of VESTAS V39/500KW wind turbine is up to 40m with 5MW total installed capacity. The essential content of this survey is to identify the use of 1000m land from the wind turbine by

laying birds and migratory birds. The supposed premise is as follows: the wind turbine has impacted birds' life in the scope of 1000m place surrounding the wind turbine.

□ Survey scope

The survey scope will be divided according to different life scope in surveyed area where birds and migratory birds live. And the scope can be divided into 6 sections (0-100m, 101-250m, 251-375m, 376-500m, 501-750m, 751-1000m). Misselwarden wind farm, occupying 330 hektare, locates between Misselawarden and North Sea dike, approx. 12km to Bremerhaven. The survey scope includes wind and surrounding places in 1km to wind farm.

□ Survey result

The interference on migratory bird from wind turbine can be displayed with the following data of 6 types of birds. All birds are suitable for the area of various distances. The nearest distance to wind turbine is only several meters. All groups of birds can be found out between wind turbines.

Goldregenpfeifer: Goldregenpfeifer flied over surveyed area. There are totally 2914 birds. The use of surveyed area is ruleless. The area of 251-375m is used more while the areas of 0-100m and 751-1000m is less than as are expected. The adverse impact on the areas over 250m from wind turbine is impossible.

Peewit: Peewit distributed in surveyed area is ruled with 9474 birds. Two areas of 0-250m are used more than as are expected. The use value in 376-1000m more deviates from the originally expected results. The accumulation in 0-250m shows that the wind turbine has no adverse impact in surveyed areas.

Lachmöwe: Lachmöwe, as surveyed area where migratory birds live, will turn out in a ruled form, with totally 4841 birds. Their use of surveyed area is ruled. The grassland in 251-375m is used more while the uses of 0-100m and 751-1000m are less than as are expected.

Starling: Starling as migratory bird turns out in the surveyed area in a ruled form, with totally 7399. Their use of surveyed area is ruleless. The plains in 0-100m and 376-500m are used more than as are expected. The adverse impact by wind turbine can be excluded for disproportion of using 0-100m area and more use of 101-250m area than others.

Sturmmöwe: Sturmmöwe as migratory bird turns out in the surveyed area in a ruled form, with totally 8864. Their use of surveyed area is ruleless. The areas in 0-100m and 101-250m are

used more while that of 251-375m and 751-1000m are less used. The deviation of use value of 0-250m from originally expected value shows that the wind turbine has no adverse impact.

Survey result: in Misselwarden wind farm, there are 35 types of birds, totally 42115, in 1995-1999. The data on 6 types of birds, frequently turning out, has been analyzed (Lachmöwe, Goldregenpfeifer, Schafstelze, Starling, Sturmmöwe, Großer Brachvogel and partridge). The use from wind farm surrounding to 100m has exceeded the expected value. Based on these data analysis, the adverse impact on migratory bird distribution from the wind farm can be excluded. Lachmöwe and Großer Brachvogel have less used the area nearer to the wind turbine. (Lachmöwe turns out in 100m, while Großer Brachvogel is in 250m. The impact on the area over 250m will be exclude for disproportion of using 251-375m area)

In short, the bird action is limited. The bird is in the still (including rest and food-finding) if it is not impacted. However the bird flying to wind turbine generally uses the corridor between wind turbines. It is observed that the birds are seldom escaping away for being close to wind turbine, i.e. the operation of wind turbine will not impact migratory birds and other birds nearby.

#### ( 2 ) Impact on migratory bird from built wind farm operation in China

Based on survey material of completion and acceptance of Shanghai (Chongming and Nanhui) wind power works (survey unit: East China Electric Power Design Institute of China power engineering consulting group corporation), Chongming and Nanhui wind farms are installed with 14 sets of 1500kW WTGS manufactured by GE, with total installed capacity of 21000kW. Chongming wind farm is over 2.3km to bird habitat; east beach of Chongming is always in silting state, and the environment for habitat and food finding of birds emerges the trend of east movement for tidal flat silting, as well as the distance between wind farm and action place is much larger. The rotary speed of wind turbine is small, with no more than 22 revolutions/min for max rotary speed and up to 550m wind turbine space. Therefore the impact on birds is little. Based on the observation from power generation of wind farm, it is proved that the wind turbine does not impact migratory birds' life.

#### ( 3 ) Impact analysis on migratory bird from this work

Yongshi wind farm is installed with 33 sets of 1500kW WTGS, with small rotary speed for wind turbine, i.e. 9.7 ~ 19.5revolutions/min and over 500m of wind turbine space. In terms of

section division for migratory bird protection in Xuwen County, Yongshi wind farm is not in migratory bird reservation zone; the construction location of this work is not in migration channel of migratory birds through the consultation from experts in local forestry department. In light of construction characteristics, the construction of this wind farm will not impact migratory birds, on the basis of above-mentioned scientific research achievements and impact analysis on migratory birds from built wind farm operation in China.

## 5 Environment protection measures

( 1 ) Construction schedule should be strictly controlled and earthworks/stoneworks should not be conducted in rainy days;

( 2 ) Housekeeping during the construction should be complied, and the ground should not be excavated, stacked and hardened at discretion. The damage of surface and vegetation should be reduced to the full and water and soil resources should be protected;

( 3 ) The peeled surface soil should be removed immediately and stacked in landform beneficial for protection as well as temporary protection should be performed well;

( 4 ) As for excavated and dismantled earthworks during operation, temporary stacking and unnecessary transport process should be reduced and directly for backfill;

( 5 ) After the construction, construction waste should be immediately cleaned and removed, the ground should be leveled as well as littering is forbidden.

( 6 ) During the foundation construction of wind turbine, transformer substation and administrative buildings, simple drainage should be arranged at construction site surroundings, blocking wall should be set around temporary residue stacking yard as well as drainage should be dug for the prevention of water and soil erosion.

( 7 ) After the wind turbine is erected, the base surroundings may be covered with grass slope and the followings can be used: Zoysia, carpet grass, Aciculate Chrysopogon and Eremochloa opiurodes etc. Some landscape plants may be sprinkled in the grass, like sunflower, marigold, Red Mulberry, Ficus sp. (cultivar), floral leaf nymphaeaceous etc. All these are to

beauty the environment for the purpose of building and conducting subject tour.

( 8 ) As for virescence of transformer and administrative zone, palm plants, such as coconut, *Roystonea regia*, *Archontophoenix alexandrae*, areca, *Ravenea rivularis*, oil plam, *Caryota urens* etc, can be planted there for torrid zone characteristics.

( 9 ) After the balance of earthworks/stoneworks, extra earthworks will be backfilled into billabong near wind turbine works and the ground should be leveled. And then the vegetation should be recovered for the purpose of the prevention of water and soil erosion.

## 6 Comprehensive assessment conclusion

The construction area is in northern fringe of the torrid zone, and physiognomy type is mesa. No original vegetation exists in the region in terms of the factors of natural conditions and man-made interference. The existing vegetations are mainly artificial economic crops and secondary shrub, with single species and relatively simple community structure. In a word, terraneous entironment of the construction is poor, however the net production of regional plant community is relatively good for vegetation recovery.

The construction occupies little floor space and causes few biomass and growth damage. And these plants are common in the local. Therefore the construction will not greatly change zoology functions in that area, neither vegetation type classification as well as little influence of heterogeneity of regional natural system. The biodiversity indicators in various vegetation type levels involved in the construction are very low, and various Shannon-Weiner biodiversity indicators are also low. The construction will not impact greatly the biodiversity in that area. In a word, the construction will not destroy zoology integrity.

The additional water and soil erosion amount by the works during construction period is fewer. The permanent land use occupies little floor space which will not greatly impact regional land use. In addition, the vegetation forming becomes another landscape through the improvement and recovery of surrounding vegetation around wind turbine, which will form new green belt. All these will beauty regional environment and form landscape layout. This farm is also developed as a new tour sight spot for people, as a harmonious and uniform landscape between human beings

and environment. From this point, the construction will be helpful to improve regional landscape.

To sum up, the construction has little impact on environment, and the influence can be released gradually through relevant environment protection measures. Therefore from the point of environment protection, Zhanjiang Yongshi wind farm by Guangdong Yuedian Group is feasible.

## Appendix II:

# Zhanjiang Yongshi wind farm by Guangdong Yuedian Group Special subject of electromagnetic radiation impact assessment

## 1 Adopted national standards and specifications

( 1 ) HJ/T2.4-1995 *Technical Guidelines for Environmental Impact Assessment- Sound Environment* ;

( 2 ) HJ/T10.3-1996 *Guidelines on Management of Radioactive Environmental protection Environmental Impact Assessment Methods and Standards*;

( 3 ) HJ/T10.2-1996 *Guidelines on Management of Radioactive Environmental protection-Electromagnetic Radiation Monitoring Instruments and Methods*;

( 4 ) HJ/T19-1997 *Technical Guidelines for Environmental Impact Assessment- Non-Polluted Ecological Impact* ;

( 5 ) GB8978-1996 *Integrated wastewater discharge standard*;

( 6 ) GB15707-1995 *Limits of radio interference from AC high voltage overhead power transmission lines*;

( 7 ) GB/T7349-2002 *Methods of measurement of radio interference from highvoltage overhead power transmission lines*;

( 8 ) GB12349-1990 *Method of measuring noise at boundary of industrial enterprises*;

( 9 ) GB12348-1990 *Standard of noise at boundary of industrial enterprises*;

( 10 ) GB3096-1993 *Standard of environmental noise of urban area*;

( 11 ) HJ/T24-1998 *TECHNICAL SPECIFICATIONS ON ENVIRONMENTAL IMPACT ASSESSMENT OF ELECTROMAGNETIC RADIATION PRODUCED BY 500 kV ULTRAHIGH VOLTAGE TRANSMISSION AND TRANSFER POWER ENGINEERING.*

## **2 Assessment factor**

Assessment factor: electric field, magnetic field and radio interference.

## **3. Assessment standard for power frequency electric field, magnetic field and radio interference**

This construction is low frequency electric field and magnetic field (50Hz power frequency), different from common high frequency electromagnetic radiation. In consideration of the concerns from the public on electromagnetic radiation, we have assessed the impact on surrounding environment from power frequency electric field and magnetic field given rise to operation of transformer substation. The assessment is performed with 4kV/m in 1.5m high from the ground, subject to recommended standard of power frequency electric field in residential area, in accordance with HJ / T24-1998 *TECHNICAL SPECIFICATIONS ON ENVIRONMENTAL IMPACT ASSESSMENT OF ELECTROMAGNETIC RADIATION PRODUCED BY 500 kV ULTRAHIGH VOLTAGE TRANSMISSION AND TRANSFER POWER ENGINEERING.* The power limits of 0.1mT in full day radicalization to the public will be considered as recommended assessment standard for magnetic induction.

The technical specification on 110kV power transmission line should be referred. In sunshine days, when the test frequency is 0.5MHz, the radio interference, 20m away from site fence and line lead, is no more than 46dB( $\mu$ V/m).

## **4 Situation assessment for power frequency electric field, magnetic field and radio interference in substation site**

In this environment assessment, the situation assessment for power frequency electric field,

magnetic field and radio interference around supposed 110kV substation site will be performed with electromagnetic radiation assessment content, compared with *Environmental impact report of Xuwen Yangqian wind farm engineering in Zhanjiang of Guangdong Province*. Based on the report, 14 monitoring points are laid out for the situation monitoring of power frequency and magnetic field in Yangqian transformer substation site, and the result is detailed in Table 1.

Monitoring instruments: EFA-300 low frequency electromagnetic radiation analyzer, verified as “Qualified” by National Institute of Metrology.

Monitoring date: August 25, 2005

Monitoring condition: cloudy.

Table 1 Monitoring result of situation for power frequency electric field, magnetic field and radio interference in substation site

Measuring point location	Measuring point number	Measuring result in 1.5m high from the ground	
		Power frequency electric field V/m	Power frequency magnetic field mT
Yangqian transformer substation	1	28	$0.60 \times 10^{-5}$
	2	26	$0.62 \times 10^{-5}$
	3	28	$0.62 \times 10^{-5}$
	4	26	$0.63 \times 10^{-5}$
	5	2.0	$0.24 \times 10^{-5}$
	6	2.0	$0.23 \times 10^{-5}$
	7	2.0	$0.23 \times 10^{-5}$
	8	4.0	$0.54 \times 10^{-5}$
	9	4.0	$0.54 \times 10^{-5}$
	10	4.0	$0.53 \times 10^{-5}$
	11	5.0	$0.54 \times 10^{-5}$
	12	5.0	$0.53 \times 10^{-5}$
	13	5.0	$0.54 \times 10^{-5}$
	14	3.0	$0.53 \times 10^{-5}$
Recommended standard limits		4kV/m	0.1mT

\* Power frequency magnetic field means the composition of horizontal component and vertical component of magnetic field.

8 monitoring points are laid out for the situation monitoring of radio interference around Yangqian transformer substation site, and the result is detailed in Table 2.

Monitoring instruments: EB200 interfering detector, verified as “Qualified” by National

Institute of Metrology.

Monitoring date: August 25, 2005

Monitoring condition: cloudy.

Table 2 Monitoring result of radio interference situation in 110kV Yangqian transformer substation site

No.	Monitoring point description	Frequent point	Monitoring result dBiV/m
1	Yangqian transformer substation	0.5MHz	20.1
2	Yangqian transformer substation	0.5MHz	19.4
3	Yangqian transformer substation	0.5MHz	18.2
4	Yangqian transformer substation	0.5MHz	19.1
5	Yangqian transformer substation	0.5MHz	18.4
6	Yangqian transformer substation	0.15MHz	20.4
7		0.25MHz	21.4
8		0.5MHz	20.1
9		1.0MHz	17.4
10		1.5MHz	22.1
11		3.0MHz	8.3
12		6.0 MHz	29.3
13		10.0MHz	20.7
14		15.0MHz	11.1
15		30.0MHz	3.7
16	Yangqian transformer substation	0.5MHz	23.1

Yangqian 110kV transformer substation site locates in north of Xinliao island of Xuwen County, and is governed by Xuwen County where Yongshi Town for this construction of transformer substation site is also in this place. The two transformer substations are approx. 20km in linear distance, with similar natural environment and geology etc, as well as similar economic development mode, i.e. relying mainly on agricultural planting economy, with little industrial enterprises. Therefore the two substations can be compared. From the comparison measuring, the

power frequency electric field of 110kV transformer substation site is 3.0 ~ 5.0V/m in 1.5m from the ground, while the power frequency magnetic field for  $(0.53 \sim 0.54) \times 10^{-5}$  mT in 1.5m from the ground. The results of power frequency electric field and magnetic field are far lower than the recommended limits in HJ/T24-1998 *TECHNICAL SPECIFICATIONS ON ENVIRONMENTAL IMPACT ASSESSMENT OF ELECTROMAGNETIC RADIATION PRODUCED BY 500 kV ULTRAHIGH VOLTAGE TRANSMISSION AND TRANSFER POWER ENGINEERING*; 0.5MHz radio interference value of 110kV transformer substation site is 18.2 ~ 23.1 dB $\mu$ V/m, complying with the standard requirements of GB15707 - 1995 *Limits of radio interference from AC high voltage overhead power transmission lines*, i.e. 46 dB $\mu$ V/m with 0.5 MHz to 110kV.

## 5 Construction content and scale:

110kV transformer substation is equipped to Yongshi wind farm.

110kV Yongshi transformer substation adopts 2 sets of SFZ10-31500/110/35kV 3-phase oil-immersed and dual winding on-load tap changer step-up transformer, and 110kV side uses single bus access way with one-time outlet. 35kV side single bus access way per section. Main transformer parameters are as follow:

Model: SFZ10-50000/115

Rated voltage:  $110 \pm 8 \times 1.25\% / 35$  kV

Yongshi wind farm in this phase will adopt one-time 110kV line access to 110kV Yonhshi substation.

## 6 Forecasting assessment of noise environment impact during substation operation

( 1 ) Executive standard for noise during transformer substation construction

in terms of various applicable standard areas in *Standard of environmental noise of urban area*: the supposed substation site locates in village area, and Class I standard of *Standard of environmental noise of urban area* (GB3096 - 1993) (55dB(A) in daytime while 45dB(A) in night).

The site of this transformer substation lies in village, with cropland round. The environment

noise around the site is 55dB(A) in daytime and 45dB(A) in night. All values in daytime and night comply with Class I standard of *Standard of environmental noise of urban area*(GB3096 - 1993).

( 2 ) Noise source and level of transformer substation equipments

The noise source of transformer mainly comes from large sound source equipments like main transformer and reactor etc, and the main noise during transformer substation generally comes from the transformer. The noise value of general standard transformer is 75dB(A). For the purpose of reducing noise source intensity of the equipments, the construction adopts low noise transformer, and the noise at 1.0m casing is no more than 70dB(A) in case of full load operation and opened radiator. The noise source of substation equipments is detailed in Table 3.

Table 3: Equipments noise sources in transformer substation

Equipment name	Noise sources, dB(A)
110kV main transformer of transformer substation(1m far from the main transformer)	70
Reactor	60 ~ 65

Noise characteristics spectrum of the transformer adopts the existed analogy test data, as shown in table 4.

Table 4: Analogy data for standard transformer and sound source octave and sound pressure level

Sound level A	Sound level C	63	125	250	500	1k	2k	4k	8k
70	73.6	61.5	66.4	67.5	68.0	62.4	54.4	43.5	36.0

From above table, noises of the transformer are mainly in low & intermediate frequency.

(3) Forecast for environment noises

Operational noise source of transformer substation are mainly from the main transformer. The project adopts low-noise transformer, which is operated with full load and whose noise level of cover shell will be not higher than 70dB (A) in case of full running of radiator. Transformer belongs to fixed noise sources, and predicted by geometric divergence decay formula without no directional point sound source at the adopting point, noises arise from the transformer have been failed to level 36 dB(A) at 50m far away from the transformer, the level is lower than the night

limit value of 45 dB(A) stated in the Class I of “Urban Regional Environment Noise Standard” (GB3096 - 1993), moreover, there are no residents in areas within 500m of the transformer substation site, therefore, the operation of transformer in substation will not produce environment noise to surrounding area.

## 7 Electromagnet radiation environment affection analysis during operation period

During normal operation, kinds of power transmission and transformation equipments will produce certain of electromagnet radiation and noise pollution; and during normal examine and repair, some solid waste such as abandoned equipments, machine oil and smeary dishcloth etc will be produced.

This is the analogy survey to power frequency electric field and magnetic field produced by operation of transformer substation.

Compare Zhuhai 110kV Cuixiang substations with Zhanjiang 110kV Xuwenyang former substation, their main indicators are shown as follows:

Table 5: Comparison table for main technical indicators of Yongshi transformer substation and Cuixiang transformer substation

Main indicators	110kV Cuixiang substation	110kV Yongshi substation
pressure level	110kV	110kV
main transformer size	3×50MVA	2×31.5MVA
Capacitor bank	6×4800kVar	4×4800kVar

Main transformer of Cuixiang 110kV substation is larger than Yongshi's, thus it is more conservative. And as other main technical indications of these two substations are same or similar, it is accessible to choose Cuixiang substation as the analogy object. These two substations are comparable as their same or similar main technical indicators.

By analogy with Cuixiang substation, the power frequency electromagnet radiation testing result is: power field intensity of 2.2V/m~4.6×10<sup>2</sup>V/m, electromagnet field intensity of 0.15μT~0.90μT, the wireless disturbing level of frequency 0.5MHz of 38dB (μV/m), and boundary noise level of the transformer substation site is: Daytime level: 51dB (A) ~56dB (A),

night level: 50 dB (A) ~55dB (A).

Said measured data is listed in Table 5 and Table 7.

Table 6: Electromagnet radiation analogy measured value for Cuixiang 110kV transformer substation

Monitoring point	Power frequency electric field intensity (V/m)	Power frequency magnetic field intensity (T)
1#	2.4	$9.0 \times 10^{-7}$
2#	2.3	$2.4 \times 10^{-7}$
3#	2.6	$1.7 \times 10^{-7}$
4#	2.5	$1.5 \times 10^{-7}$
5#	2.4	$1.7 \times 10^{-7}$
6#	2.5	$1.6 \times 10^{-7}$
7#	2.2	$1.6 \times 10^{-7}$
8#	2.3	$1.9 \times 10^{-7}$
9#	2.4	$2.0 \times 10^{-7}$
10#	2.5	$2.0 \times 10^{-7}$
11#	2.4	$2.1 \times 10^{-7}$
12#	2.6	$3.6 \times 10^{-7}$
13#	2.4	$3.6 \times 10^{-7}$
14#	2.5	$7.3 \times 10^{-7}$
hall in 1F	4.6	$2.5 \times 10^{-7}$
Standard limit	$4 \times 10^3$ (HJ/T24-1998)	$1 \times 10^{-4}$ (HJ/T24-1998)

Table 7: Noise analogy measured value for Cuixiang 110kV transformer substation

Unit: dB (A)

Monitoring point	night	daytime	noise source
Northeast corner in the site	54	55	freight flow in Leyuen Road
Southeast corner in the site	50	51	
#1 main transformer	52	52	
#2 main transformer	50	51	

Southwest corner in the site	55	56	construction
Northwest corner in the site	54	55	
standard limit	45 (GB12348-90)	55 (GB12348-90)	

## 8 Environment protection regulating measures

(1) Low noise-generating machineries shall be used for substation construction and high noise-generating machineries should be avoided for nighttime construction.

(2) The noise source of main transformer shall be under control. Viewing that the noise generated by standard transformer should be 73dB (A), the main transformer adopted by current project can meet the noise control requirement of not generating a noise greater than 70dB (A).

(3) Effect a reasonable disposition of electric equipments for substation according to surrounding condition of wind farm site, place some noise generating equipments on the side of which the noise control requirement is relatively lower, elevate the fence and improve greenization within the location to absorb sound, reduce noise and alleviate the impact on surrounding sound environment.

(4) Supply ground connection devices for all electrified equipments in the substation to reduce the intensity of static induction.

(5) In order to prevent the main transformer from affecting surroundings when accident occurs, it is taken into consideration to equip the site with an emergency oil pool when designing the project. Therefore when accident occurs to transformer, the oil will flow from transformer directly into the emergency oil pool and will then be recycled after being treated by separation device, the oil from transformer will under no circumstance be exhausted to outside.

## 9 Conclusion

The environment electromagnet radiation upon the analogy test is in conformity with requirements of power frequency electric field intensity limit value of 4000V/m (recommended value) and magnetic field intensity limit of 0.1mT(recommended value) in the “Environment affection evaluation technology standard in electromagnet radiation from super-high pressure

transmission and distribution project ”; analogy noise fails to conform with requirements of Class I in “Industrial Enterprise and Plant Noise Standard”: night noise limit of 45dB(A) and day noise limit of 55dB(A). As there are no residents in the area within 200m of the transformer substation site, the noise will not disturb residents.

From above results, there are no residents in the area within 500m of the transformer substation site, upon the completion of the project, the power frequency electric field and magnetic field produced by the substation will be considerably lower than recommended value (power frequency electric field intensity limit of 4000V/m and magnetic field intensity limit of 0.1mT) in evaluation standard, thus the substation will not bring surrounding residents electromagnetic radiation affection.

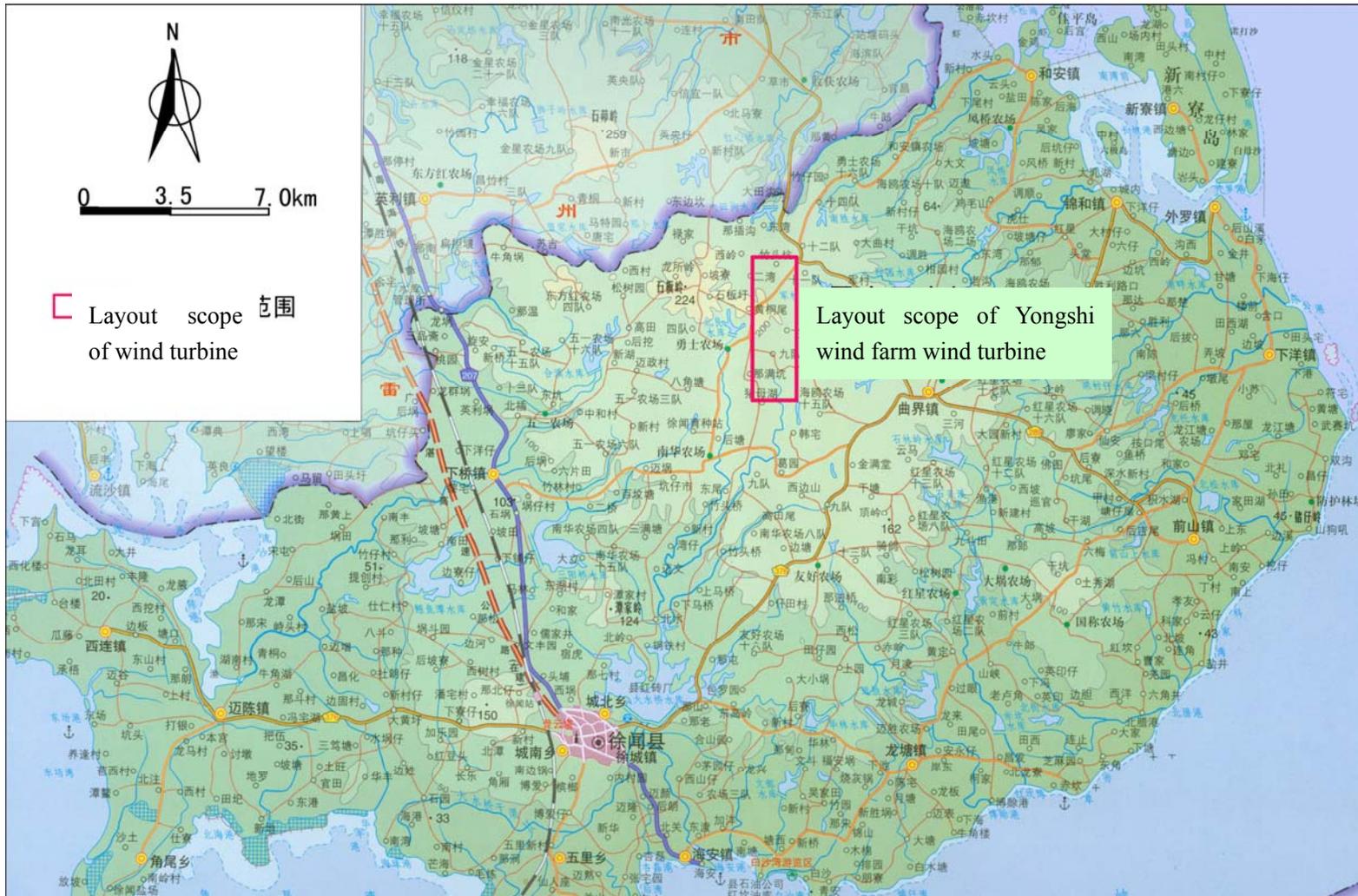
In conclusion, the project selected site and construction are accessible in the electromagnet evaluation.

## **10 Suggestions**

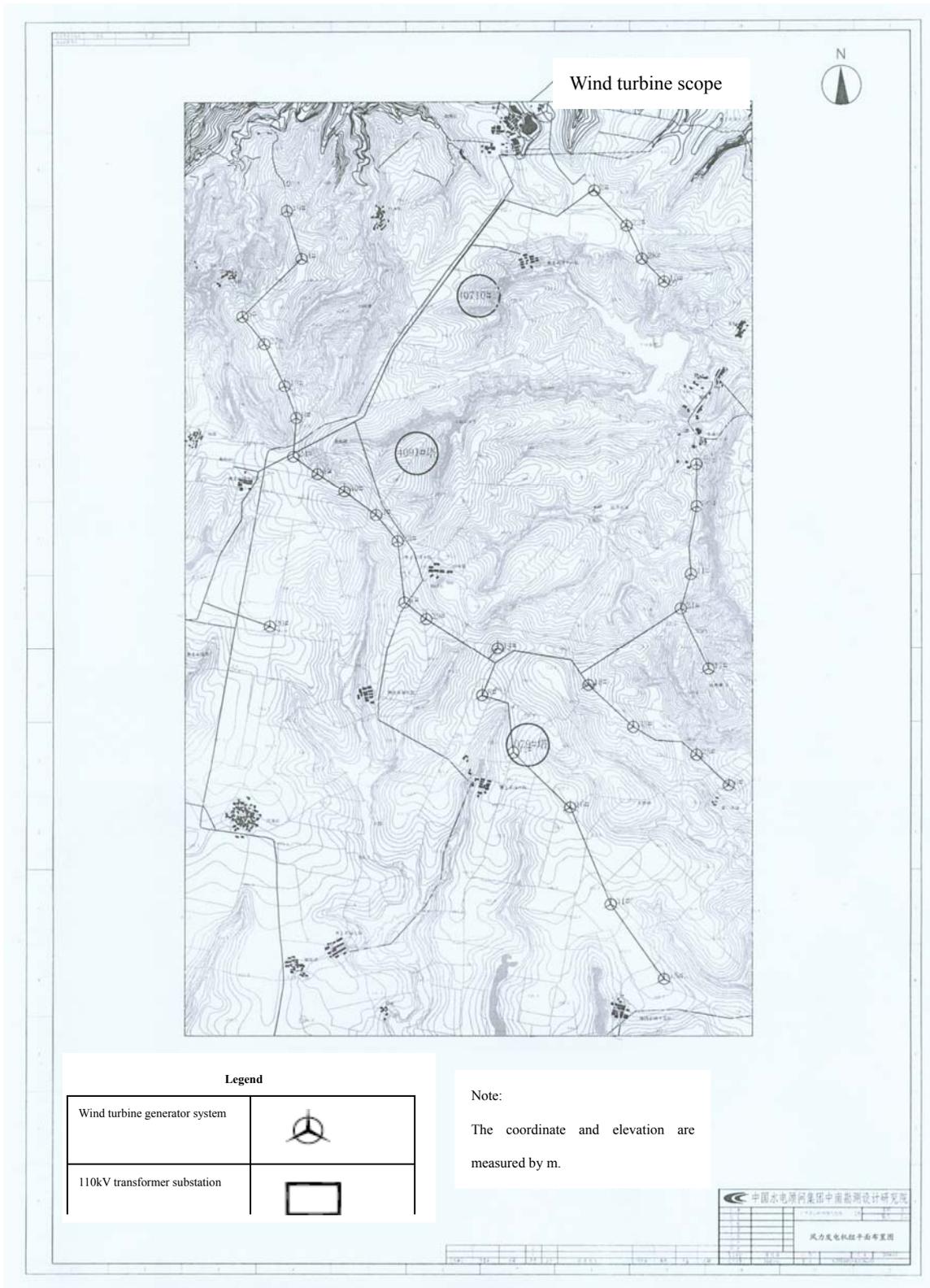
(1) Properly screen the electric equipments producing electromagnetic radiation such as transformer, breaker, and current-voltage mutual inductor to reduce the radiation as possible. As electromagnetic radiations of the transformer substation are mainly produced with the substation, the working staff shall be protected.

(2) For reducing noises of transformer substation as much as possible, low-noise wind turbine and main transformer are suggested; and in the design of transformer substation, general layout shall be further optimized with collected collocation of high-noise equipments.

(3) For the project, with referring to the provision on overhead power circuit protection area, the Article 5 in “Implementing Details for Electric Apparatus Protection Regulations”, it is suggested to take distance of 4m away form the wall of main control building of the transformer substation as the protection distance.



Attached drawing 1 Construction geographical location map



			2						
			1						
Sign unit	Signatory	Date	Serial number	District number	Revised content	Revised by	Proofread by	Inspected by	Date

 Mid-South Design & Research Institute, CHECC					
Verified by			Yongshi Wind Farm Project in Xuwen		Feasibility study phase
Reviewed by			County by Guangdong Yuedian Group		Construction part
Inspected by			Layout plan of wind turbine generator system		
Proofread by					
Designed by					
Drawn by					
Issuing unit	Ministry of Housing and Urban-Rural Construction	Scale		Date	May 2008
Design	A143000032	Chart No.	GDYDYS49.5-KY-SG-01		

Attached drawing 2 Wind turbine generator system layout plan



*Eucalyptus* spp., *Ananas comosus*



*Eucalyptus* spp.



*Saccharum officinarum* L



*Musa sapientum*



*Ananas comosus*



*Camellia sinensis* – transformer substation construction land

Attached drawing 3a Photos of Yongshi wind farm construction project locus environmental status



Team 18 of Yongshi Farm  
Transformer substation construction land west side 550m  
(*Ananas comosus*, *Eucalyptus* spp.)



Environmental status of transformer substation south side  
(*Camellia sinensis*)



Environmental status of transformer substation north side  
(*Saccharum officinarum* L *Eucalyptus* spp.)



Environmental status of transformer substation east side  
(*Saccharum officinarum* L *Eucalyptus* spp.)

Attached drawing 3b Photos of Yongshi wind farm construction project

locus environmental status



	Chemical oxygen demand*															
	Ammonia nitrogen*															
	Petroleum															
	Exhaust gas	—	—			—	—									
	Sulfur dioxide *															
	Dust*															
	Industrial dust*															
	Nitrogen oxides															
	Industrial solid waste*															
	Correlative contamination relating to project															

Remarks: 1. Emission volume of increase and reduction: (+) defines for increase, (-) defines for reduction

2. (12) defines for this project in the area is special for replacing reduction volume for this project by "regional balance"

3. (9)=(7)-(8) , (15)=(9)-(11)-(12) , (13)=(3)-(11)+(9)

4. Measure unit: waste water emission volume—10,000ton/year; exhaust gas emission volume—10,000Mm3/year; industrial solid waste emission volume—10,000ton/year; water contamination emission concentration—mg./liter; atmosphere contamination emission concentration—mg./m3; waste contamination emission volume—ton/year; atmosphere contamination emission volume—ton/year.

