

Environmental Assessment Report

Summary Initial Environmental Examination
Project Number: 41926
February 2009

PRC: Zhangbei Wind Power Project

Prepared by the staff consultants for the Asian Development Bank (ADB).

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A. Introduction

1. The China Energy Conservation Investment Corporation (CECIC) won through a national competitive bidding process organized by the National Development and Reform Commission (NDRC) the concession rights for 25 years to develop a wind power project of 100.5 megawatts (MW) on a build-operate-own basis at Lūnaobao in Zhangbei County, Zhangjiakou Municipality, Hebei Province.

2. The Zhangbei Wind Power Project (the Project) will be implemented by a special purpose vehicle in the form of a Sino–foreign joint venture indirectly 70% owned by CECIC and indirectly 30% owned by the HKC (Holdings), Ltd., (HKC). The total project cost is estimated to be CNY932.0 million, 34% of which will be financed by equity from two sponsors and 66% by long-term debts provided through a proposed Asian Development Bank (ADB) loan. Special funds have been allocated for environmental protection and conservation of water and soil in the project area.

3. The Project will install 67 wind turbine generators (WTGs), each with a rated output of 1.5 MW, on ridges ascending from northwest to southeast, perpendicular to the prevailing wind direction from the north. The Project is the sixth wind power project developed by CECIC in Zhangbei and planned to be fully commissioned by early 2010. The Project's capacity factor is projected to be 28.5%, providing 2,497 hours (h) of operation at full-capacity equivalent and supplying 250.9 gigawatt-hours of clean electricity from renewable wind resources per annum to mitigate chronic shortage on the North China Power Grid (NCPG).

4. Coal-fired thermal power plants currently dominate electricity generation in the northern People's Republic of China (PRC), accelerating resource depletion, exacerbating environmental deterioration, and causing ever-rising costs of electricity for industrial, commercial, and residential uses. The Project's main objective is to utilize abundant local wind resources more effectively to replace 86,118 tons (t) of standard coal per year and to abate greenhouse gas (GHG) emissions by avoiding more than 5.5 million ton of carbon dioxide emissions during the 25-year concession. The Project's estimated pollution reduction is summarized in Table 1.

Table 1: Resource Conservation and Pollution Emission Reduction
(tons)

Item	Per Annum	For the 25-Year Concession Period
Standard coal	86,118	1,980,719
SO ₂	1,984	45,637
NO _x	1,126	25,902
CO ₂	242,127	5,568,910
Smoke	20,950	523,750
Ash	21,530	495,180
Freshwater	5,900	135,698

CO₂ = carbon dioxide, NO_x = oxides of nitrogen, SO₂ = sulfur dioxide.

Source: The Environmental Impact Assessment reports for Zhangbei Wind Power Project by the Hebei Provincial Academy of Environmental Sciences, November 2007.

5. The Project contributes to poverty reduction and promotes sustainable development in the project area because it (i) provides power to stimulate and support the expansion of local industry and service businesses; (ii) creates employment during construction and operation and provides opportunities for developing ecotourism; (iii) improves local physical infrastructure such as access roads and transmission networks; and (iv) protects the regional ecological

environment by reducing such air pollutants as sulfur dioxide, smoke, and ash and conserving resources, such as 5,900 t of freshwater per year, as compared with a business-as-usual approach to generating electricity by burning fossil fuels.

6. The environmental impact assessment (EIA) for the Project was conducted by the Hebei Provincial Academy of Environmental Sciences. It was approved by the Hebei Provincial Environment Protection Bureau in November 2007. The Hebei Water Conservation Bureau approved the water and soil conservation plan for the Project, and the Ministry of Land and Resources approved the land use plan in January 2008.

7. This summary initial environmental examination is based on comprehensive environmental impact studies, including the EIA, for the Project and direct consultations with stakeholders. The examination was prepared for ADB in line with its environmental and social safeguards policies and information disclosure requirements for category B projects.

B. Description of the Project

8. The Project involves constructing and operating a 100.5 MW wind power generation facility. Technical parameters designed for the Project are presented in Table 2.

Table 2: Technical Parameters

Parameter	Zhangbei
Number of WTG	67
Unit Capacity of WTG	1.5 MW
WTG Rotor Diameter	77 m
Hub Height	61.5 m
Number of Blades per WTG	3
Total Power Generation Capacity	100.5 MW
Cut-in Wind Velocity	3 m/s
Rated Wind Velocity	12.5 m/s
Cut-out Wind Velocity	20 m/s
Safety Wind Velocity	53.3 m/s
WTG Rotor Speed	9.7–19.0 r/m
Total Area Required	0.71 km ²
For permanent uses	0.39 km ²
For temporary uses	0.32 km ²
Extreme Wind Velocity at 65 m	41.1 m/s
Average Wind Velocity at 70 m	8.42 m/s
Wind Energy Density at 70 m	492.3 w/m ²

km² = square kilometer, m = meter, m/s = meter per second, MW = megawatt, r/m = rounds/minute, w/m² = watts per square meter, WTG = wind turbine generators.

Source: The Environmental Impact Assessment reports for Zhangbei Wind Power Project by the Hebei Provincial Academy of Environmental Sciences, November 2007.

9. The WTG selected for the Project was designed by the Repower GmH of Germany and is manufactured by the Dongfang Electric Corporation of the PRC. More than 1,600 units of this type of WTG have been installed worldwide. Under the equipment supply contract, the manufacturer provides a 24-month warranty, which guarantees a per unit WTG yield curve of no less than 95% of the guaranteed value and an average WTG availability of no less than 95% of the applicable availability percentage for all units of the wind farm collectively. The power generated will be evacuated from the substation connected to the NCPG through a 220 kilovolt

line. According to the renewable energy law, the NCPG is responsible for building transmission lines to connect the wind farm to the existing power grid and to purchase 100% of the electricity generated by the Project.

C. Description of the Environment

10. **Project Location.** Abutting on the southern rim of the Inner Mongolia Plateau, the project site is centered at 114°32'30" east longitude and 41°03'50" north latitude. The project site altitude ranges from 1,500 meters (m) to 1,600 m above the mean sea level. It is 17 kilometers (km) from Zhangbei County Town and 242 km northwest from Beijing, making it close to the Beijing-Tianjin-Tangshan load centers. The project site is 21 km from the national highway connecting Beijing to Hohhot, the capital of the Inner Mongolian Autonomous Region.

11. The project area has a semi-arid, intermediate temperate continental monsoon climate, featuring a long and cold winter, dry and windy spring, and short and hot summer. The project site and its environs are the driest and coldest area in Hebei. Its annual rainfall is 300 millimeters, and its annual average air temperature is 2.6 degrees Celsius.

12. Zhangbei has some of the richest wind resources in the northern PRC, as it is on the regular route for frequent southbound cold highs from Siberia and the Mongolian Plateau, which rapidly sweep toward the North China Plain with strong winds. Total commercially exploitable wind power resources in Zhangbei are estimated to be around 5,000 MW. NDRC selected Zhangbei as the PRC's first 1,000 MW wind power development district. More than 10 companies are currently developing or operating wind farms in or near Zhangbei. CECIC has developed five wind farms nearby, including one at Danjinghe as a joint venture with HKC.

13. The project site is favorable for wind power development. The average annual wind velocity at 70 m above ground is 8.42 m per second (m/s) and the annual wind energy density at 70 m is 492.3 watts per square meter. The frequencies for the five wind directions (west-northwest, northwest, north-northwest, southeast, and south-southeast) sum to 71.5%, and the probability for the wind velocity ranging between 3 m/s and 25 m/s stands at 99.96%. The estimated maximum wind velocity averaged over a 10-minute interval occurring once every 50 years is 41.1 m/s.

14. **Physical Environment.** The project site is mostly uninhabited and degraded grassland, with many rock outcrops and gravel areas with scarce vegetation. The soil is arid, mainly sand and silt with little agricultural value. The project area has certain natural water sources, including both surface and groundwater, but does not enclose any identified archeological, historical, cultural, or religious sites or commercial deposits of mineral resources. The air and water quality is typically average for the region. The background noise comes mainly from wind.

15. **Biological Environment.** Because of the dry climate, the project site and its surrounding areas have no large trees apart from those planted in villages. There are no wildlife sanctuaries, reserve forests, bird sanctuaries, and rare or endangered species of animals or plants in the vicinity. There are no specific migration paths of birds near the project area.

16. **Socioeconomic Environment.** Human settlements are found only in areas below where the wind farm is located. With an area of 4,185 square kilometers (km²), Zhangbei had a population of 370,800 in 2007, 83% of which depend on agriculture and animal husbandry¹ and

¹ The rural population is distributed in 18 towns, 366 administrative villages, and 1,167 natural villages.

are thus vulnerable to the harsh climate. In 2006, the county's GDP stood at CNY2.5 billion, and the net income per farmer was merely CNY2,773 (\$347), which is less than \$1 per day and among of the lowest in the PRC.

D. Land Acquisition and Resettlement

17. **Land Acquisition.** The land to be affected by the Project will total 0.71 km², of which 0.39 km² (54%) will be permanently occupied and 0.32 km² (46%) temporarily used. Most lands are on currently unproductive ridges and have been acquired through negotiations with the villagers as willing sellers.

18. **Indigenous Peoples and Resettlement.** No indigenous people live close to or within the sites identified for the wind farm. As the sites are vacant, there is no need for resettlement arrangements. Therefore, ADB's *Involuntary Resettlement Policy* (1995) and *Policy on Indigenous Peoples* (1998) are not triggered.

E. Environmental Impacts and Mitigation Measures

19. Environmental protection standards in the PRC have been strengthened in recent years. The construction and operation of wind farms must strictly follow a series of national standards, including the following:

- (i) Ambient Air Quality Standards (GB3095-1996) Grade II;
- (ii) Surface Water Quality Standards (GB3838-2002) Grade III;
- (iii) Standard of Environmental Noise in the Urban Area (GB3096-1993) Grade I;
- (iv) Ecology Quality Standards;
- (v) Air Pollutant Discharge Standards (GB16297-1996) Grade II;
- (vi) Sewage Discharge Standards (GB8978-1996) Grade I;
- (vii) Construction Site Noise Limits (GB12523-1990) Grade III; and
- (viii) Industrial Sector Noise Standards (GB12348-1990) Grade II.

1. Impacts and Mitigation Measures during Construction

20. Project construction entails only minor civil, mechanical, and electrical works over a relatively short period on several small areas scattered over a wide area. Construction, particularly the construction of a 1.8 km road from the main road to the wind farm, will create some small and transient environmental disturbances such as noise, exhaust emissions, and flying dust from moving trucks and heavy equipment. No groundwater will be tapped for construction work. The effect on vegetation, animals, water and soil loss, and the atmosphere are scant. Earth excavated during road construction will be used for road embankments and minor leveling of the site during site restoration after construction. The wastes from about 150 workers, estimated to be 37.5 kilograms per day, will be collected and transported to the county garbage treatment site.

21. The 67 WTGs will be erected sequentially using only two to four cranes. Construction and installation equipment will be removed upon completion, and the ground will be cleaned so that the land can be reused. Vegetation cover spoiled during temporary land uses will be regenerated within 3 years. The nearest residence is at least 500 m away from the project site, and noise from the operation of heavy equipment will be below 50 decibels (dB).

22. Construction will generate direct and indirect temporary employment for both casual and skilled labor. Health and safety measures will be implemented, including AIDS prevention. The

existing culture and health of the local populations will not be affected as the construction period will be very short.

2. Impacts and Mitigation Measures during Operation

23. The operation and maintenance² of wind farms does not involve any atmospheric emissions or effluent discharges. Fluids and other waste materials associated with typical maintenance will not be stored on site and will be disposed of off site in approved landfills.

24. The main environmental impacts of the Project during operation and the corresponding mitigation measures are as follows:

- (i) **Land use.** The land occupied by the wind farm is not arable, and the permanently occupied land is very small and properly purchased.
- (ii) **Bird fatalities.** The WTGs will not endanger migratory birds or bats as there are few in the wind farm area, which is not located in the main habitat or along the main migration routes of migratory birds. According to the project EIA, the death rate of birds and bats will not rise because of the Project.
- (iii) **Noise.** The operating noise of 1.5 MW WTGs ranges from 90 to 102 dB, and drops quickly to 45 dB at a distance of 500 m. As the nearest residences are at least 500 m away from the wind farm, they will not be affected by the noise.
- (iv) **Air pollution.** The WTGs do not generate any air pollution emissions.
- (v) **Visual intrusion.** WTG towers erected far from inhabited areas will not create adverse visual impacts, as the ridge on which the wind farm is located is not known for its natural beauty. The turbine design minimizes the flickering effects of blade rotation. Villagers plan to develop ecotourism using the wind farms to attract tourists interested in clean energy development.
- (vi) **Air traffic safety.** The Project will strictly adhere to regulations regarding air traffic safety relevant to tall WTG towers. In line with regulations for air navigational markings, the upper section of the towers and turbine blades will be marked with bands of a specified width to enhance their visibility. Blinking lights will provide clear identification at night. No impact on air traffic safety is anticipated.
- (vii) **Soil erosion.** Transformers at each WTG tower and the substation have been designed, and will be properly maintained, to avoid soil erosion.
- (viii) **Magnetic radiation.** Magnetic radiation from a wind farm is low, and the health of residents and local electrical equipment will not be affected.
- (ix) **Waste management.** The 24 cubic meters of wastewater and 12.5 kilograms of trash generated per day during operation are minimal. The wastewater will be treated on site for recycling, and the garbage will be collected and disposed of at the county's garbage collection station, with little impact on the environment.

25. The project area has experienced seismic tremors ranging from 2.0 to 6.2 on the Richter scale. The WTGs, towers, and buildings have therefore been designed, and will be constructed, to be able to withstand lateral ground movements caused by seismic shocks. Insurance policies are required to cover possible losses from natural disasters.

² Routine maintenance will be conducted throughout the lifetime of the wind turbines, generally amounting to 80 hours a year and mainly being the maintenance of the turbine, rotor, and electrical components; lubrication of parts; and full generator overhaul.

F. Institutional Requirements and Environmental Management Plan

26. **Organizational Structure, Roles, and Responsibilities.** As the project company is responsible for constructing, operating, and maintaining the WTGs and the facilitating system, it will be accountable for environmental management and monitoring. The project company will ensure that it and all subcontractors comply with all regulations and conditions for various construction and operation activities. The Hebei Provincial Environment Protection Bureau will validate at the end of project construction that all environmental issues have been properly handled and will issue a formal certificate if the handling fully meets national requirements. Without such a certificate the wind farm cannot be commissioned. During the operation period, the Zhangbei County Environment Protection Bureau is required by the Hebei Provincial Environment Protection Bureau to conduct periodic examinations on the environmental issues related to the Project.

27. **Environmental Management Plan.** A social and environmental management plan (SEMP) has been formulated to articulate potential impacts, corresponding mitigating measures, and the implementation timeframe, with carefully designed monitoring arrangements. Carrying out the SEMP will minimize environmental and social disturbances associated with the construction, operation, and maintenance of the Project. The general manager of the project company, assisted by the heads of operations and administration departments, will bear the responsibility for satisfactory implementation of the SEMP. The SEMP and the environmental monitoring program are presented in Tables 3 and 4.

G. Public Consultation and Disclosure

28. CECIC has conducted many activities to raise awareness on wind energy development in the project vicinity. Local communities have demonstrated good understanding of the nature and scope of wind energy projects. Formal public consultation sessions were held during project due diligence in November 2008 and were attended by relevant stakeholders, including representatives of local residents and governments, to solicit their views on the Project and its environmental and social aspects. The outcome of these consultations has verified that the Project has no significant negative environmental and social impacts. In fact, the local communities welcome wind power projects with expectations for emerging economic opportunities and additional tax revenues to support social welfare programs that directly benefit local low-income groups. Furthermore, CECIC will exercise its social corporate responsibilities to provide assistance for community development.

H. Conclusions

29. Sufficient data and analyses exist to conclude that the Project, generating renewable energy from wind resources on marginal land with insignificant economic and ecological value, contributes to reducing GHG emissions and delivers long-term economic, environmental, and social benefits. Disturbances during construction will be small and transient and can be properly managed. The perceptible environmental impacts during operation are mostly noise and visual intrusion, but both are considered to be minimal given the WTGs' distance to the nearest settlements and the limited landscape value of the project site. If the project company properly implements the SEMP, the Project is unlikely to cause any significant or lasting negative environmental or social impacts. Existing information is adequate to justify environmental and social clearance of the Project without requiring further environmental or social assessments.

Table 3: Social and Environmental Management Plan

Environmental Issues	Mitigation Measures	Time Frame
Land use	<p>Restricting construction-related activities within the project area.</p> <p>Minimizing temporary land uses through sequentially erecting wind turbines by sections.</p> <p>Carrying out daily site inspection to ensure removal of construction materials, debris, or surplus earth materials.</p>	During site clearance and construction
Ecological issues	Restricting vegetation removal within the wind farm area and for road alignment.	Before start of construction
	Compensatory plantation using local plant species.	During and after construction
Natural habitat	<p>Restricting all activities, construction vehicle movement, and other events within the project area.</p> <p>Avoiding temporary disposal of excavated materials.</p> <p>Locating worker camps and stock yards properly, not to disturb natural habitats.</p>	During site clearance and construction
Traffic control and safety	<p>Vehicle used for delivery of materials to be well maintained and approved by the authority.</p> <p>Temporary traffic control during transportation of wind turbines.</p>	During site clearance and construction
	<p>Barricading the site with adequate marking flags, reflectors, etc. to the extent possible for safety of general traffic.</p> <p>Enforcing traffic control measures, including speed limits of delivery trucks and service vehicles of engineers and other staff personnel.</p>	During site clearance, construction, and operation
Dust emissions	Watering construction sites periodically to minimize fugitive dust generation while laying foundation and during evacuation and construction works.	During construction
Noise	<p>Construction equipment should be equipped with exhaust silencers, and should be used only during daytime.</p> <p>Regular maintenance and service of equipment to adhere to applicable noise standards.</p> <p>Ensuring that workers wear earplugs and earmuffs to avoid noise impacts.</p>	During construction
	<p>Monitoring the noise levels at sensitive receptors as per monitoring plan.</p> <p>Regular maintenance of wind energy converter.</p>	Routinely during operations

Environmental Issues	Mitigation Measures	Time Frame
Storage of construction materials	Storing construction materials containing fine particles in an enclosure such that sediment-laden water does not drain into nearby water drains.	During construction
Soil erosion	Stabilizing slopes on road and any embankments (through measures such as reapplying the top soil removed during construction to retain spores of grass and shrub species) to control sedimentation, erosion, and water pollution. Also consider the use of geotextiles to prevent soil erosion.	During construction
Visual impact	Minimizing new road construction. Painting wind turbines, blades, towers, and structures with a neutral nonreflective color.	During construction
Labor camps and construction facilities	Ensuring that contract conditions are followed for maintaining hygienic conditions at the work site. Ensuring availability of first-aid kits as required. Training at least one person on the effective uses of first-aid facilities in case of any injury.	During construction, erection, and commissioning
Occupational health and safety	Ensuring compliance of all safety and health rules and uses of necessary safety equipment.	During construction
Public health and safety during construction	Taking proper care during loading and unloading to avoid mechanical injury. Providing necessary and sufficient illumination to avoid glare. Providing the necessary safety equipment such as safety nets, helmets, safety belts, etc. Preventing unauthorized personnel from accessing the towers and other hazardous or restricted areas. Providing temporary shade in the nearby area so that workers can rest at different intervals and avoid sunstroke. Providing sufficient and hygienic drinking water at work areas. Retaining the nearby available medical services' contact number and address for emergency use. Covering sharp edges properly to avoid cut injury. Preparing the standard safety toolbox before starting the job.	During erection and commissioning of wind turbines
Waste management	Ensuring proper and contained disposal of enamel and paint drums and other wastes. Providing adequate treatment facilities to treat sewage generated from toilets and canteen.	Routinely during operations

Environmental Issues	Mitigation Measures	Time Frame
Public health and safety during operation	<p>Providing minimum safety setback of 150 meter from any property line.</p> <p>Designing site plan to comply with the requirement of aviation authorities to avoid electromagnetic interference.</p> <p>Complying with the national regulatory standards to ensure the safe operation of wind turbine rotors.</p> <p>Preventing unauthorized personnel from accessing towers and other hazardous or restricted areas.</p> <p>Developing an operational and emergency response program for fire and major accidents including emergency equipment.</p> <p>Checking road embankment for erosion and rutting, any sign of instability to be taken care.</p> <p>Identifying the personnel for monitoring and mitigating the effect of project on environmental and sociocultural resources.</p> <p>Providing all safety measures and sanitary facilities.</p> <p>Keeping tower entrance doors under lock and key.</p>	During operation
Electromagnetic interference	<p>Compliance with guidelines and other requirements to avoid EMI with aviation equipment.</p> <p>Fiberglass blades are partially transparent to electromagnetic waves, and therefore do not generally cause EMI.</p>	During operation
Training and awareness	Training the employees and contractors and arranging awareness programs for site workers and in nearby communities (including awareness on preventive measures for HIV/AIDS).	Periodically
Environment, health, and safety (EHS) assessment	Periodically evaluating and assessing the EHS activities and planning for improvements.	Periodically

EHS = environment, health, and safety, EMI = electromagnetic interference, HIV/AIDS = human immunodeficiency virus/acquire immune deficiency syndrome.

Source: Environmental impact study reports for the Zhangbei Wind Power Project.

Table 4: Environmental Monitoring Program for the Zhangbei Wind Power Project

Component	Parameters	Location	Frequency	Duration	Responsibility
Construction Period					
Land Use	Actual usage in m ² to be strictly within the permitted usage	The project site: Both permanent and temporary land uses	Monthly		The project company, in coordination with the Zhangbei Environmental Protection Bureau, under the general guidance of the Hebei Provincial Bureau of Environmental Protection
Air Quality	TSP, PM ₁₀ , SO ₂ , and NO _x	Project site (access roads, foundation of tower structure, and location of new transformer site)	Once every season: summer, winter, post monsoon	24 hours a day for 2 consecutive working days per week for 2 weeks	
Noise Level		Project site (access roads, foundation of tower structure, and location of new transformer site)	Once every season: summer, winter, post monsoon	Continuous 24 hours reading with a frequency of 10 minutes for 2 nonconsecutive days per week for 2 weeks	
Operation Period					
Air Quality	TSP, PM ₁₀ , SO ₂ , and NO _x	Project site	Once every season: summer, winter, post monsoon for 1 year after operation starts	24 hours/day	The project company, in coordination with the Zhangbei Environmental Protection Bureau, under the general guidance of the Hebei Provincial Bureau of Environmental Protection
Noise	Noise level	Project site (access roads, foundation of tower structure, and location of new transformer site)	Once every season: summer, winter, post monsoon for 1 year after operation starts	Continuous 24-hour reading with a frequency of 10 minutes for 2 nonconsecutive days per week for 2 weeks	
Ecology and Visual Impacts	Survival rate of site forestation and other plantation/vegetation	Project site with forestation and vegetation maintenance focus	Annually	For 3 years after operation starts	

m² = square meter, NO_x = oxides of nitrogen, PM = particulate matter, SO₂ = sulfur dioxide, TSP = total suspended particles.

Source: Environmental impact study reports for the Zhangbei Wind Power Project.