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PROJECT PROFILE

RENEWABLE ENERGY BY A WIND TURBINE SYSTEM ON LAMMA ISLAND

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Revision 0

The Hongkong Electric Co., Ltd.
香港電燈有限公司

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1. INTRODUCTION

The Hongkong Electric Company Limited (HEC) is committed to providing quality power supply to its customers with due care for the environment. Recognizing the importance of sustainable development, HEC is proposing to install a wind turbine as a demonstration project to utilize wind energy for power generation on Lamma Island, Hong Kong.

Lamma is an outlying island suitable for harnessing renewable wind energy for consumption by the islanders. Existing power supply to Lamma is by means of 11kV power lines, transformer pillars and low voltage distribution cables. The proposed wind turbine will be connected to the existing power grid for supplying of "green" energy to Lamma residents.

This Project Profile serves to outline the environmental information of the proposed wind turbine and associated equipment to be installed at a suitable site on the island for application for a study brief to proceed with an EIA study under Section 5.1 (a) of the Environmental Impact Assessment Ordinance (EIAO, Cap. 499).

2. BASIC INFORMATION

2.1 PROJECT TITLE

Renewable energy by a wind turbine system on Lamma Island.

2.2 PURPOSE AND NATURE OF THE PROJECT

Generation of renewable electric energy using a wind turbine.

2.3 NAME OF PROJECT PROPONENT

The Hongkong Electric Company Limited (HEC).

2.4 LOCATION AND SCALE OF PROJECT

2.4.1 Site Identification

Following completion of a 12-month wind power monitoring at Lamma in November 2002, a wind atlas has been developed to assess the wind potential of Lamma Island. Figure 1 shows the "isovent" map of equal power density in terms of energy per swept area of wind turbine blades. Areas of wind power density over 150W/m^2, equivalent to the average wind speed of about 5.5m/s, are in general considered suitable for wind energy utilization. Site surveys and technical feasibility studies have been conducted in 2003 to identify suitable site and plant capacity for the proposed wind turbine system on Lamma Island. Due to site constraints with respect to access and height restriction, it is only technically feasible to install wind turbine of capacity ranging from 600 to 850kW on Lamma Island.

Site screening process is largely driven by engineering requirements and environmental considerations. As heavy trucks and mobile cranes will be required for transportation and erection of the wind turbine, construction of any new access road will cause significant disruption to the existing landscape. A practical approach has been adopted to identify sites along the existing 275kV cable routes which are the only vehicular roads on the island.

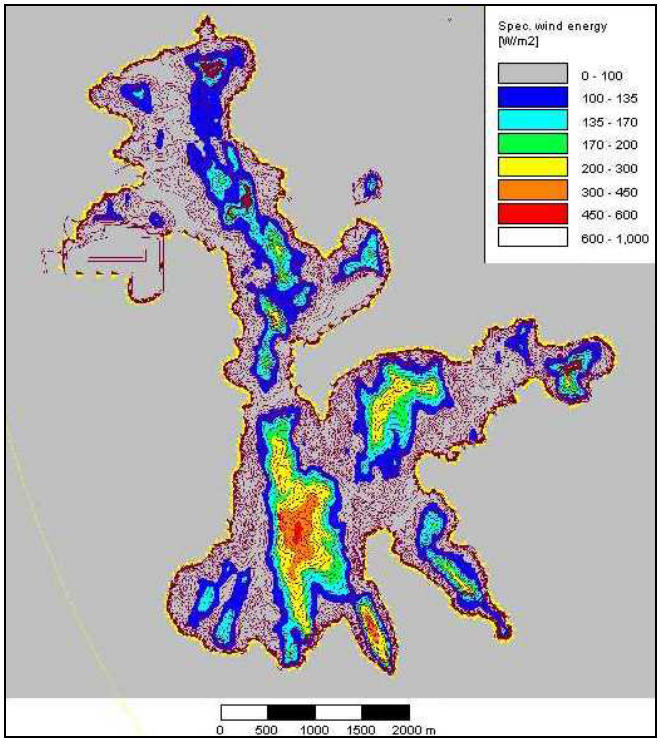


Figure 1 – Wind Resource Map of Lamma Island

The possible sites resulting from application of constraint mapping techniques have formed a long-list of potential sites (Figure 2):-

Site 1 - Lamma Power Station Extension
Site 2 - Tai Ling
Site 3 - Yung Shue Long
Site 4 - Tai Peng
Site 5 - Pak Kok Tsui
Site 6 - Lamma Quarry

Having identified sites that meet the broad environmental and engineering criteria, a site-specific appraisal has been exercised to establish a short-listed of feasible sites for further detailed investigation.

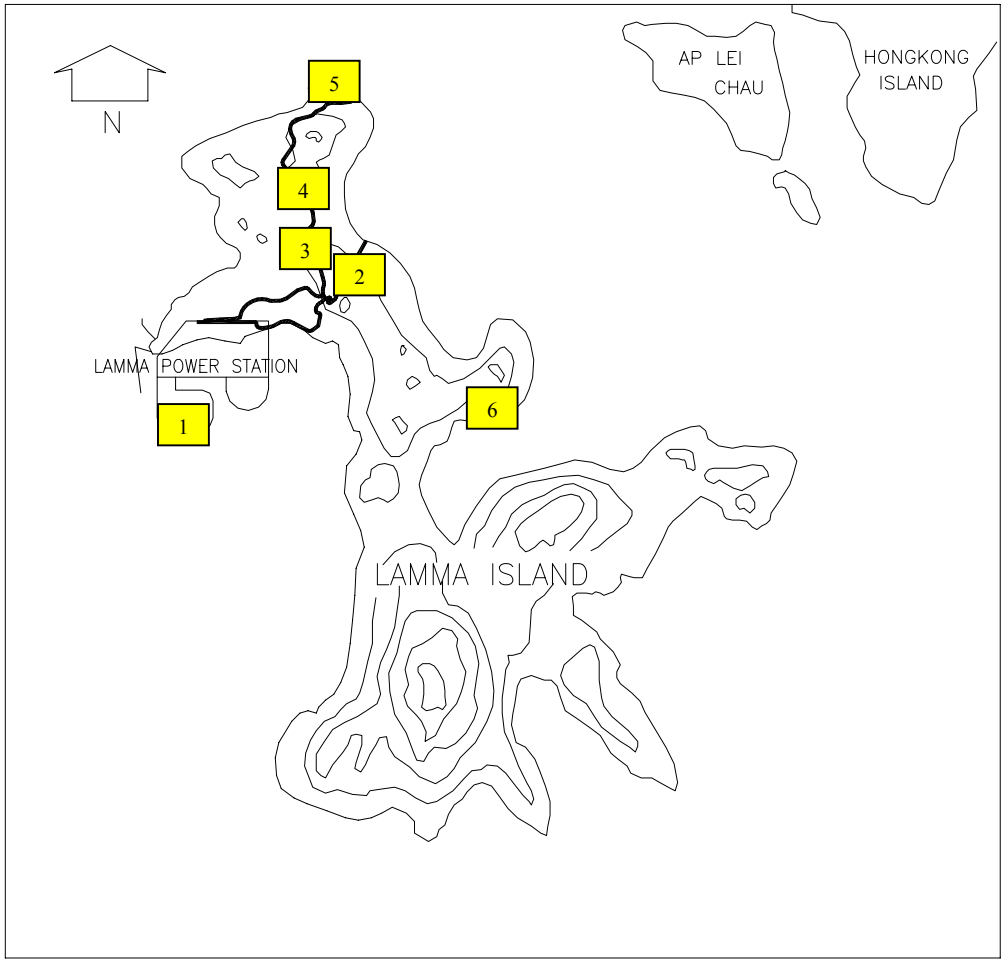


Figure 2 – Long-listed Site for Wind Turbine Installation

Qualitative approaches have been adopted to identify potential conflicts with the development of the wind turbine. Each potential site is scrutinized more closely with engineering criteria on wind potential, geological considerations and electrical connection; and environmental criteria on visual, noise and ecology. Of the 6 long-listed sites within the areas of least constraints established, four sites have been excluded due to principal conflicts identified, leaving following two sites for the final comparative assessment (Figure 3):

Site 2 - Tai Ling
Site 4 - Tai Peng

The short-listed sites have been evaluated and compared according to the potential impacts likely to arise as a sequence of construction and operation of the wind turbine system. Site 2 – Tai Ling is identified as the overall preferred site due to its distinct merits in site access, ground conditions, noise and visual impact against Site 4 – Tai Peng. The planned capacity of the wind turbine is 600 to 850kW depending on the model sizes available from respective suppliers.

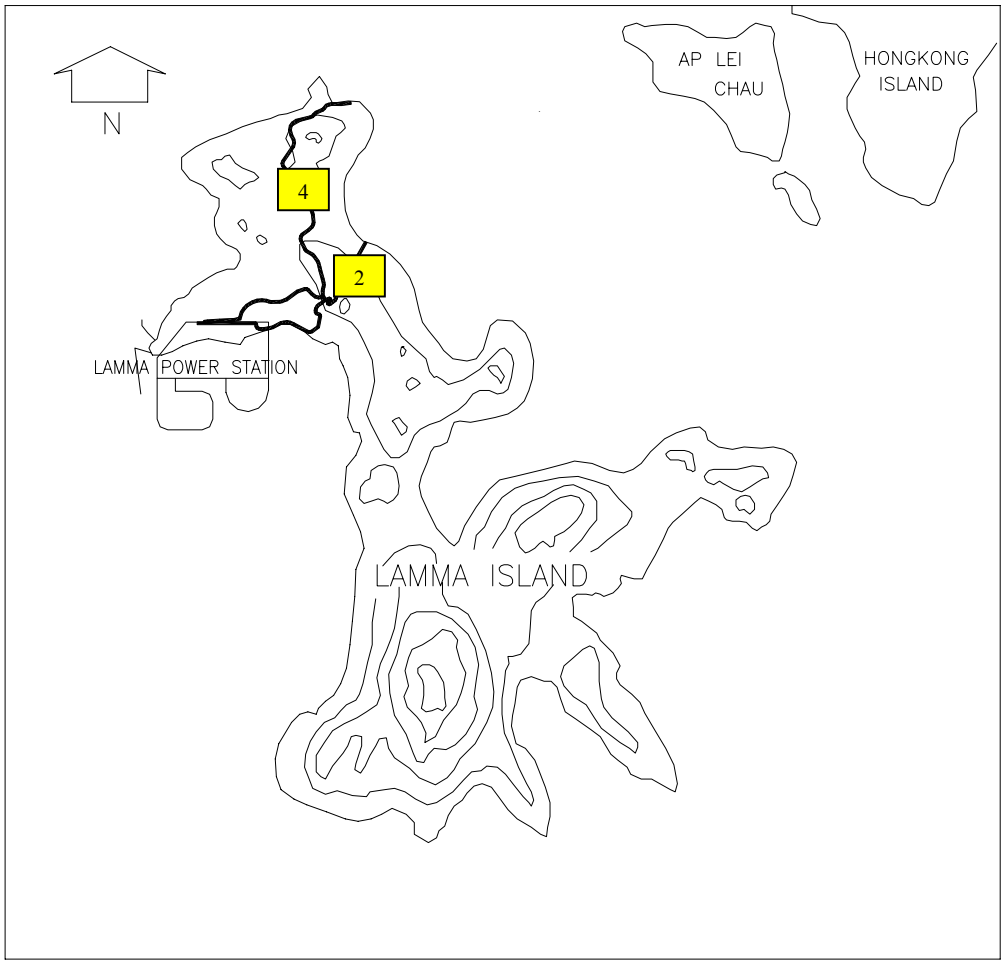


Figure 3 – Short-listed Site for Wind Turbine Installation

2.4.2 Scale of Project

Site 2 – Tai Ling is a piece of flatland situated at north of Tai Ling Village and is about 250m from the nearest dwellings (Figure 4). The site has an elevation of 90m above the Principal Datum (PD) of Hong Kong and is adjacent to the HEC's existing cable route. The wind turbine will comprise basically of 3 rotor blades, a nacelle and a tapered monopole. Hub height and rotor diameter of a 600-850kW wind turbine are 45 and 52m respectively (Figure 5). The weight of tower and nacelle plus blades is 44 and 45 tons respectively.

Underground distribution cables of approximately 50m will be installed for delivery of electricity produced from the wind turbine to a nearby 11kV grid via a step-up transformer and a switchgear. Power control and protection device will also be provided for a safe and reliable operation under various operating conditions.

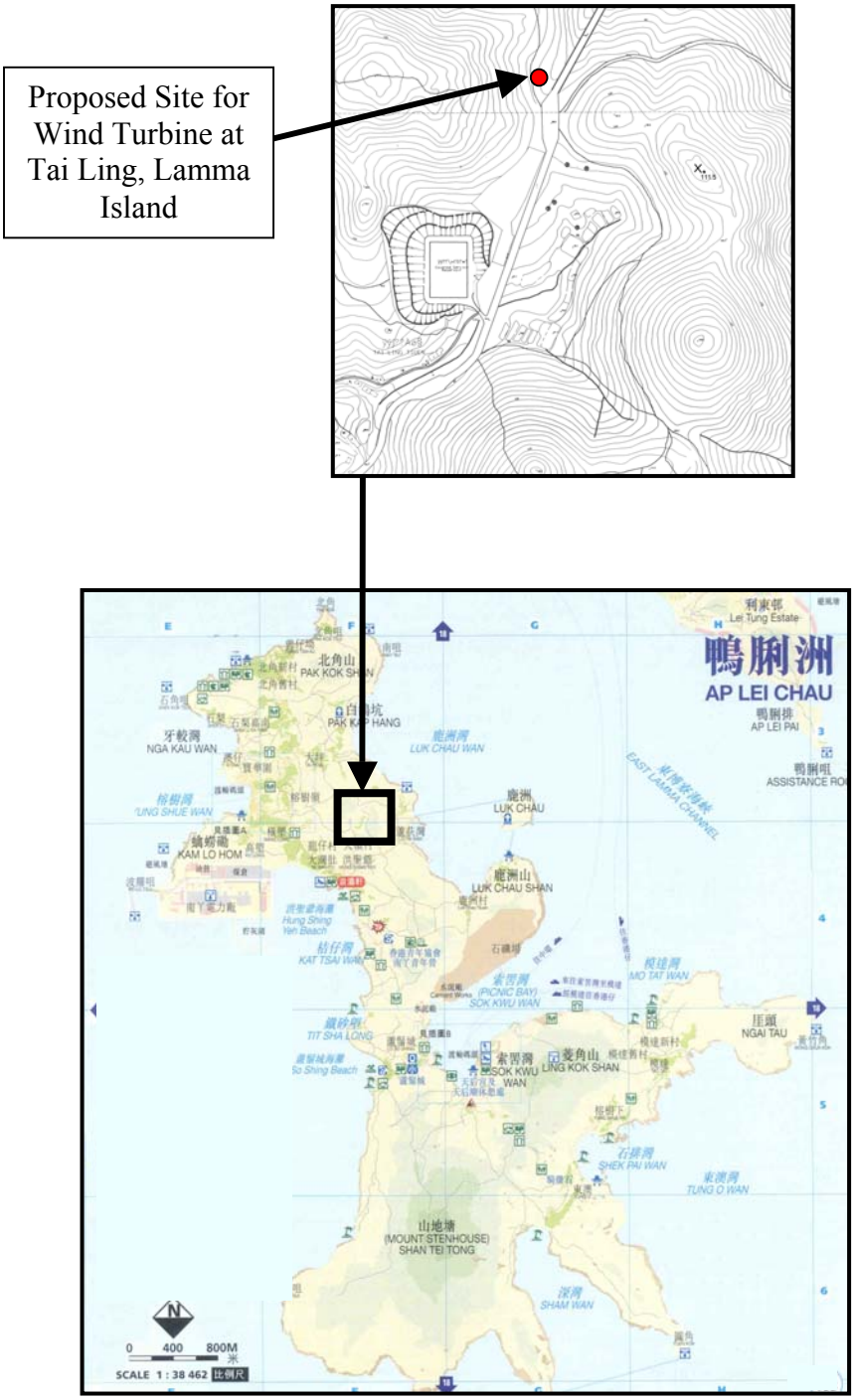


Figure 4 – Location of the Proposed Site for Wind Turbine

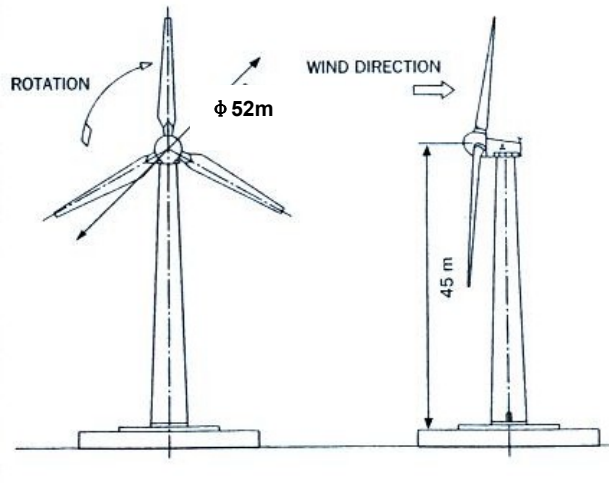


Figure 5 – Outline of a Typical 600-850kW Class Wind Turbine

2.5 DESIGNATED PROJECTS TO BE COVERED BY THE PROJECT PROFILE

This Project Profile will cover the following designated project:

- Construction and operation of a 600-850kW wind turbine and associated equipment.

2.6 NAME AND TELEPHONE NUMBER OF CONTACT PERSON

Ms. Mimi Yeung, General Manager (Public Affairs)
Tel. no: 2843 3268

Mr. Andrew Lu, Public Affairs Manager
Tel. no: 2843 3287

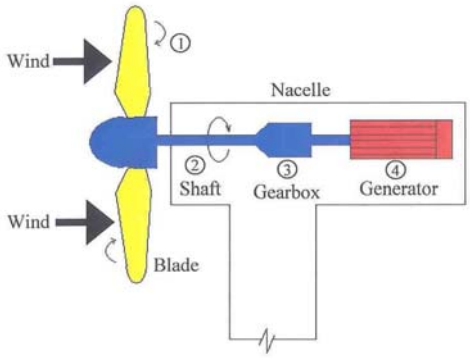
3. PROJECT PLANNING AND IMPLEMENTATION

The whole project will be planned and implemented by HEC's in-house staff together with consultants and contractors. Site erection will commence in late 2005 and commissioning of the project is scheduled for early 2006.

4. POSSIBLE IMPACT ON THE ENVIRONMENT

4.1 OUTLINE OF PROCESSES INVOLVED

The proposed wind turbine is a "horizontal axis" machine which consists of three rotor blades turning around a horizontal hub. The hub is connected to a gearbox and a generator which are located inside a nacelle. The nacelle houses the mechanical and electrical components and is mounted on the top of a tubular tower. The mechanism of power generation by wind turbine is illustrated in Figure 6.



(1) Wind blowing over the blades causes the blades to rotate

(2) Rotating blades keep the shaft turning

(3) & (4) The gearbox will increase the rotational speed of the shaft and drive the generator to produce electricity

Figure 6 – Mechanics of Electricity Generation by Wind Turbine

Transformer, switchgear and power conditioning devices will be installed in two stainless steel huts (4.5m L x 2.5m W x 2.5m H). Distribution cables will be buried underground for connection to the nearby existing 11kV grid on the cable route.

As illustrated in the schematic diagram (Figure 7), the output from wind turbine is transmitted to the existing power grid. The synchronous generators of the grid system supply magnetizing current for the induction generator of wind turbine. An Auto-synchronous Controller will be required to control the operation of a Synchronizing Breaker with respect to the wind turbine output voltage and frequency.

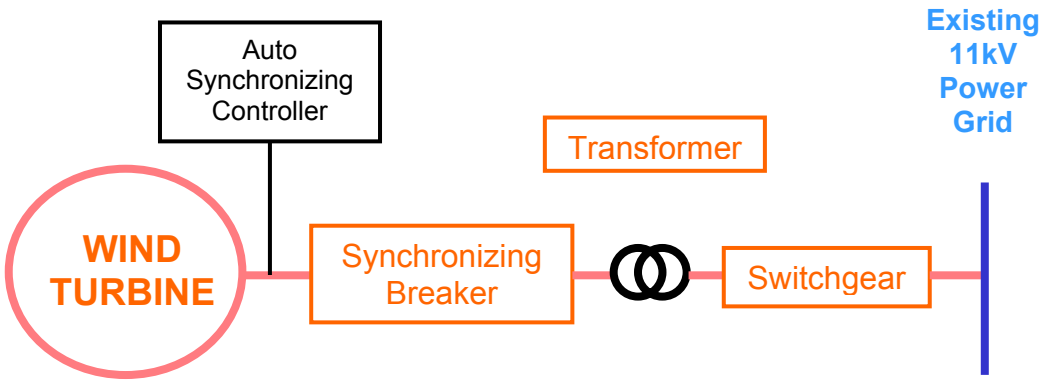


Figure 7 – Schematic Diagram of Proposed Wind Turbine Installation

4.2 POTENTIAL ENVIRONMENTAL IMPACTS

The construction work involves setting up one wind turbine and two equipment huts, and laying of 50m of underground distribution cables. Only limited powered construction equipment will be used due to relatively small scale of the project and pre-assembled equipment. The operation of wind turbine will not consume fuel and generate waste or side products. Major impacts during operational phase are associated with rotating blades. The potential environmental impacts arising from construction and operation of wind turbine are highlighted below:

4.2.1 Construction Phase

(a) Air Quality

Wind turbine foundation requires an area of 15m x 15m and the excavated materials will be generated from the foundation construction. All debris and waste materials will be covered or stored in a designated area to minimise fugitive emission. Gaseous emission from the on-site diesel generators and mobile equipment is expected to be negligible. Fugitive and gaseous emissions during construction phase are expected to be localised and temporary only. No adverse impact of air quality during construction phase will be envisaged.

(b) Noise Impact

Limited powered mechanical equipment (PME) will be used during a short construction period of the wind turbine. Major noise sources will be vehicles, mobile cranes and diesel generators. The nearest sensitive receivers (NSR) at Tai Ling Village are over 250m from the proposed site and separated by the topography. Construction works during restricted hours will be under governance of a statutory permitting system. The attenuation due to setback and terrain is expected to keep the general construction noise at the NSR well below the statutory limits.

(c) Water Quality

Only limited raw water will be used for concrete mixing during construction phase. No site runoff is expected and no adverse impact on water quality is anticipated.

(d) Ecology

The proposed site is on north of Lamma, well away from ecological sensitive areas in south Lamma where conservation area, potential sites for country park and site of special scientific interest are found. The ground consists of bare granite with vegetation covering on thin soil. The foundation of wind turbines and equipment huts will require an area of approximately 15m x 15m and 10m x 3m respectively. The new power cable will be buried underground and the disturbance to vegetation will be kept minimal. The species of shrub at the vicinity of site are unknown but can be easily avoided if identified to be the protected or rare plants. The impact to ecology is expected to be negligible.

4.2.2 Operational Phase

(a) Air Quality

Wind turbine produces electricity without gaseous emissions. The "green" wind power will displace fossil fuel and reduce emission from conventional power generating plant.

(b) Noise Impact

Modern turbines are having aerodynamic airfoils and well-insulated nacelle to minimize noise impact. Wind turbine produces low level noise when turbine blades pass through the air. This aerodynamic sound is minimised by careful attention to the design and manufacturing of the blades. Sound generated by the gearbox and generator is minimised through efficient engineering, and any remaining noise is contained within the nacelle by using insulation materials. Typically a 600-850kW wind turbine has a maximum noise level of about 55dBA at a distance of 50m and it will be further reduced to less than 40dBA at a distance of 250m. The long setback between the proposed site and residential area at Tai Ling will not introduce noise problem during operational phase.

(c) Ecology

Documented evidences show that the ecological impacts during operational phase will be confined to birds strike. Overseas experiences of wild birds collision with wind turbines are both site and species specific. Birds collide with structures which they have difficulty in seeing, especially high voltage overhead lines and windows of building, or been trapped. Wind farms with dense arrays of wind turbines sited closed to foraging territory or on the migratory routes of some types of birds may be a problem. One single wind turbine is believed visually obvious to birds if proper colour scheme is adopted. Birds often have good sight and tend to change their flight route some 100-200m away from the obstacle and pass above or around it at a safe distance. The birds found at Lamma are mostly local species and will soon familiar with the changes of features in their living environment. It is expected that the proposed development will have insignificant impact to birds.

(d) Visual and Landscape

The proposed wind turbine has hub height of 45m and swept area about 2200m^2. The elevation at the proposed site is about 90mPD. The wind turbine placed on this site will have a maximum elevation of about 161m PD. They are unavoidably conspicuous and visible from some residential areas and hiking paths on north Lamma and South District.

The visual intrusion on landscape from wind turbines is highly subjective. Many people see them as a welcome symbol of clean energy whereas as some find them unpleasant additions to the landscape. Understanding of the broader environmental benefits of wind energy tends to improve the public reaction to a wind project.

Objective prediction of appearance will be carried out for a careful integration of development into the landscape.

The effects of the periodic reflection or interruption of sunlight will be addressed by careful consideration of machine siting and of the surface finish of the blades. These phenomena are entirely predictable and their amelioration is easily integrated into wind turbine design at the outset.

5. MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

The proposed site is on a site platform with a gentle slope of bare rocks and soils. The ground vegetation is dominated by low shrub, climber and grass. Pockets of taller shrub and tree are scattered in nearby valleys and some slopes. The site and its surrounding area have been zoned as greenbelt. The site area and its adjoining allotments are mostly government land and abandoned farmland. The residential dwellings are found about 250m away at Tai Ling Village.

Sham Wan Archaeological Site, which is one of the most important archaeological sites in Hong Kong, is over 4km away from the proposed site. The Tin Hau Temple at Sok Kwu Wan, which is more than 150 years old, is about 2.5km from Tai Ling Village. There are hiking trails and footpaths presently in use near the proposed site.

6. DESCRIPTION OF MITIGATION MEASURES

Based on the above assessment, the construction and operation of the proposed wind turbine is not expected to result in any adverse environmental impacts with the implementation of the following mitigation measures:

(a) Implement good site management practices for construction waste management and general noise mitigation such as:

- All debris and construction waste will be covered or stored properly before removed from the site. Windblown litter and dust will be minimised by impervious sheets or sheltered storage in accordance with Air Pollution Control Ordinance.

- Excavated material will be segregated from other wastes to avoid contamination and reused, as far as practicable, for backfilling at site.

- General noise mitigation measure will be employed at work site throughout the construction phase such as selection of quiet powered mechanical equipment, use of portable noise barriers at source and rescheduling of some noisy equipment to less sensitive time periods.

(b) Computer-generated photomontages and animations, together with mapped zones of visual influence, will provide an accurate prediction of wind turbine appearance. Careful architectural consideration and colour selection would be

made to enable the development to blend well with natural surroundings and minimise the visual intrusion.

(c) The following mitigation measures will be incorporated at the design stage to minimise the potential impact to birds:

- Proper colour scheme (e.g. non-reflective surfacing) will be applied on rotor blades and tower to make the wind turbine visually obvious to birds.

- Tubular Tower and enclosed nacelle will be adopted to reduce the perching and nesting opportunity for birds.

- Transmission cable will be buried underground to minimise the potential bird strike risks.

- Low rotating speed machine will be chosen.

7. USE OF PREVIOUSLY APPROVED EIA REPORT

No previously approved EIA has been conducted on the proposed project.