

**Hong Kong Offshore Wind Farm in Southeastern Waters
Confirmed Minutes of the Sixth Stakeholder Liaison Group (SLG) Meeting
held on 1st February 2013 from 2:30 pm to 4:30 pm in CLP head office**

Present:

Ms. Ada CHAN (CLP Power) – Stakeholder Liaison Group Chairman
 Prof. CHAN Lung-sang (HKU)
 Prof. LAM Kit Ming (HKU)
 Prof. NG Cho-nam (HKU)
 Mr. Mike KILBURN (HK Bird Watching Society)
 Dr. CHENG Luk-ki (Green Power)
 Prof. Gerald PATCHELL (Friends of Sai Kung)

Absent with Apologies:

Prof. Alexis LAU (HKUST)
 Ms. Gloria CHANG (Greenpeace)
 Mr. LOK Shui Sang (Sai Kung Rural Committee)
 Mr. CHENG King-man (Sai Kung Fishermen's Association)
 Dr. YAU Wing-kwong (Tai Po Environmental Association)
 Mr. LING Man Hoi (Member of Sai Kung District Council)
 Mr. WONG Yung-Kan SBS JP (LEGCO Member, Agriculture and Fisheries Industry)
 Mr. Frederick YU (Hong Kong Mountaineering Union)

Also present were SLG Facilitator Timothy J. Peirson-Smith, selected CLP Staff and environmental consultant from ERM.

| Ref. No. | Issues/Discussion | Follow-up Actions and Responsible by |
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| 1. | <p>Review of the 5th SLG meeting minutes</p> <p>1.1. The Facilitator began the 6th meeting by reviewing the SLG Team's actions from the 5th SLG meeting on 6th July 2012.</p> <p>1.2. The Facilitator went through the 5th meeting SLG minutes and asked for any updates on 1) carrying out night-time bird monitoring by radar (<i>Ref.2 of the 5th SLG minutes</i>), 2) extending bird monitoring beyond the life of the Environmental Permit (<i>Ref.5 of the 5th SLG minutes</i>), 3) extending bird monitoring duration in operation phase (<i>Ref.6 of the</i></p> | |

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| | <p>5th SLG minutes) and 4) including porpoise monitoring system and Fisheries Enhancement Plan in the OWF budget (Ref.7 and 8 of the 5th SLG minutes).</p> <p>1.3. The Chairman and ERM reported that there were no updates on the above issues pending government's approval on the project.</p> <p>1.4. An SLG member suggested changing the word "geotourism" used in Ref.8 of the 5th SLG minutes to "educational visit" or "educational tourism".</p> | <p>The meeting minutes has been revised and updated www.clp.com.hk/offshorewindfarm</p> |
| <p>2.</p> | <p>2.1 The Facilitator invited the Chairman to begin the presentation.</p> <p>2.2 The presentation would be divided into three parts, Overview of Instrumentation System installed at Meteorological Mast (Met Mast), Data Collection Interim Review and Wind Farm Feasibility Study – Update and Next Steps.</p> <p>Overview of Instrumentation System Installed at Met Mast</p> <p>2.3 The Chairman mentioned that instruments related to 1) Wind Measurement, 2) Wave/Current/Sea Level Measurement, 3) Structural Tilt/Settlement Measurement, 4) Air pressure, air density, air temperature, solar radiation, 5) Aviation and Navigational Safety System and 6) Access and Security System, were successfully installed in platform B in April 2012 and has started collecting data since May 2012.</p> <p>2.4 The Chairman emphasised safety is the first priority of the project. Therefore, a short met mast (less than 45m) is adopted due to the safety concerns for maintenance workers to prevent the risk of maintenance work at height.</p> <p>2.5 Regarding the Wind Data Collection, the Chairman stated that cup anemometers, wind vanes and LiDAR System were used.</p> <p>2.6 The Chairman explained that the wind speed is measured at hub height (wind turbine height from sea level, about 90m). Given the wind speed generally increases with height due to surface friction, wind speed will also be measured along the height of the wind turbine location to find out the optimum height that can generate wind power</p> | |

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| | <p>efficiently.</p> <p>2.7 In order to understand the wave, current and sea level behaviours for design optimisation, installation and maintenance purposes, Acoustic Doppler Current Profiler (ADCP), had been installed at sea bed to detect the wave height, current speed at different levels and change of sea level.</p> <p>2.8 The Chairman stated that being the first use of Suction Can Foundations in Hong Kong, the Met Mast's settlement and tilting behaviour are measured and monitored especially during storms.</p> <p>2.9 The Chairman introduced other environmental data collection instruments on the Met Mast including air temperature sensor, lightning strike counter, air pressure sensor, relative humidity, solar radiation – pyranometer and a rain gauge.</p> <p>2.10 An SLG member asked if there is any other environmental data to share, the Chairman replied that other environmental data will be available in the next SLG meeting, but no lightning strike was recorded in the period so far.</p> <p>2.11 An SLG member asked about the method used for measuring air density.</p> <p>2.12 The Chairman explained that in terms of the power supply of the Met Mast, the existing batteries can store electricity for about 10 days without adequate sunshine. Nevertheless, the Met Mast experienced over 12 days without sunshine in Dec 2012. Thus, the current power supply is marginally sufficient for the instrumentation systems now in place.</p> <p>2.13 The Facilitator stated that this power supply point has been discussed in many previous SLG meetings, and the power storage seemed just adequate to cover current demand.</p> <p>2.14 AN SLG member suggested installing a micro wind turbine to provide back-up power in case of further extended periods with low sunlight.</p> | <p>The Chairman stated that the Project's experts wind consultant would present how air density is measured at the next SLG meeting.</p> |
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| | <p>2.15 The Chairman stated that different facilities such as fall arrestor system are provided to avoid any injuries of the workers. Contractors are required to wear life jackets and safety harnesses before climbing up the Met Mast.</p> <p>2.16 For emergency, a mobile phone and torch are provided at platform A. An emergency button at platform A can activate the flashing beacon and buzzer when pushed.</p> <p>2.17 The Chairman stated that the Met Mast tower is painted in orange and white with aviation light installed at top of the mast as aviation safety measures. For navigational measures, the structure (from Platform B to sea surface) is painted in yellow; marine lanterns are installed at four corners of platform B; the fog horn will be turned on at visibility below 2 nautical miles and the radar reflectors are installed at the Met Mast tower.</p> <p>2.18 In terms of met mast access, a warning sign is installed at platform to alert the public not to enter the Met Mast. CCTVs are also installed at platform A and B for real time security monitoring.</p> <p>2.19 An SLG member agreed that installing CCTV is a good idea, and asked if it could capture the potential bird strike during the operation phase of the wind farm.</p> <p>2.20 ERM stated that the issue of placing bird monitoring equipment was discussed in the 4th SLG meeting, further investigation will be carried out on the location and effectiveness subject to government's approval of the project.</p> <p>2.21 Another SLG member followed up on the issue and asked if any bird dropping or other signs of bird perching were observed on the Met Mast. The Chairman replied that no obvious case had been observed and ERM suggested CLP could instruct the contractors to have regular checking and take photos for record.</p> | <p>The Chairman stated this could be considered if the OWF received government's approval of the project.</p> <p>The Chairman agreed to instruct Met Mast contractors to have regular checking and take photos for record.</p> |
| <p>3.</p> | <p>Data Collection Interim Review</p> <p>3.1 The Chairman started the interim review on the data collected since May 2012.</p> | |

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| | <p><u>Wind Data</u></p> <p>3.2 From May-Dec 2012 (till Jun 2013 to capture one year full data), the average wind speed measured is generally in line with the preliminary forecasts.</p> <p>3.3 The data collected each month is being compared with Hindcasting Wind Speed and Waglan HKO data. The long term average wind speed at the OWF for next 10-20 years can be projected by using historical reference station data such as Waglan HKO data. The Chairman presented that the average wind speed will be further analysed to obtain the wind speed frequency distribution (the amount of time each wind speed will occur for energy assessment) and wind rose (dominant wind direction for wind farm design). North-east (NE) direction is expected to be the dominant direction according to historical wind data.</p> <p>3.4 The Chairman showed the example power curve and the formula to calculate the power that can be generated.</p> <p>3.5 An SLG member questioned on the figures of the two saturated levels of the power generated at wind speed 0-4m/s and 12-25m/s, and pointed out that it cannot assume the increase in wind speed will necessarily lead to certain levels of increase in wind power. Upper and lower cut-off need to be included in the calculation.</p> <p>3.6 The Chairman and ERM explained that the power curve shown is only an example to demonstrate the calculation method.</p> <p>3.7 An SLG member pointed out the turbine will be turned off if the wind speed is too high and the turbine could not be operated if the wind speed is too slow, and suggested that these factors should be included in the calculation. The member also asked how much energy output would make the project worthwhile.</p> <p>3.8 The Facilitator recapped the discussions of previous SLG meetings and stated that the previous meetings had discussed that the cost, the energy output and the carbon embedded in the OWF production would be fully considered to determine if the project is feasible or not.</p> | <p>The Chairman offered that the consultants will explain the methodology used in Hindcasting case in the next SLG meeting.</p> <p>The Chairman offered that their consultants will explain further in detail at the next SLG meeting once the data collection is completed.</p> |
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3.9 The Chairman supplemented that the types of wind turbine used are different for low and high wind speeds, so the nature of the optimal turbines will be decided based on the data collected.

Wave Data

3.10 The Chairman mentioned that the peak significant wave height was over 5m during recorded typhoons, which is still within the design assumption.

3.11 An SLG member asked about the wave height under tsunami. The Chairman stated that the chance of tsunami in Hong Kong is very rare. Another SLG member supplemented that tsunami would not have much effect on wave height at the open sea, the wave heights usually only rise when approaching the coast.

3.12 For the wind and wave distribution, potential mis-alignment has been observed. The direction of the biggest waves and biggest winds are not the same and this observation needs to be considered for the structural design.

Current Data

3.13 Peak current speed of over 2m/s was recorded during storms an SLG member questioned about the reliability of the current data collected especially during storms. The Chairman agreed and stated that more measurement will be done and findings will be shared in the SLG meeting. .

Sea Level Data

3.14 The tidal range measured is in line with the design requirement and storm surge measured shows potential exceedence over the Design Codes requirement. More wave and current data is to be collected to optimise the design.

3.15 An SLG member mentioned that the storm surge is significantly higher than 2m and asked for the historical surge record in Hong Kong. The Chairman replied that there is

The Chairman stated that findings will be shared with the SLG.

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| | <p>no storm surge record on this site, which needs to be measured.</p> <p>3.16 Another SLG member supplemented that the storm surge would not have much effect in the open sea area. However, another SLG member disputed that and said storm surges can raises the water level significantly for an extended period of time off shore.</p> <p><u><i>Tilting and settlement Data</i></u></p> <p>3.17 According to the data collected, the actual tilt and settlement are within the design predictions.</p> | |
| <p>4.</p> | <p>Wind Farm Feasibility Study – Updated and Next Steps</p> <p>4.1 The Chairman presented the project updates. The Suction Can Foundation Design for Wind Farm had recently been approved by the Buildings Department. The Facilitator commented this was good news for the OWF feasibility study.</p> <p>4.2 Concerning the next steps, the 12 months wind data and other environmental data collection will be completed by June 2013 and wave data is to be collected till end of Dec 2013 if everything goes smoothly. The relevant interim study findings will be reviewed with the government by mid-2013 and the environmental impacts will be taken into consideration continuously in project planning and design.</p> <p>4.3 In addition, permission for carrying out ground investigation works will be applied under the Foreshore and Sea-bed (reclamations) Ordinance in order to collect geotechnical data for optimisation and finalisation of the wind farm foundation design.</p> <p>4.4 After collecting the data and going through the government procedures, a commercial feasibility study will be conducted to prepare the project cost based on the development size, selected foundation designs and wind turbines.</p> | <p>The Chairman stated that full Met Mast data collection findings will be shared with the SLG members.</p> |

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| 5. | <p>Follow up Discussions on the Presentation</p> <p>5.1 An SLG member asked about the details of the operation of the electricity transfer from offshore to onshore.</p> <p>5.2 The Chairman replied that the electricity would be first collected in the centralised offshore substation. The offshore substation will step up the voltage transferred to the onshore substation (located at Tseung Kwan O) through cables.</p> <p>5.3 The SLG member further supplemented his question by asking how would this affect the base loading plan and adjust other types of generation on the grid as it cannot be separated.</p> <p>5.4 The Chairman replied that the Tai Po control centre would forecast the daily electricity demand in advance. The projected generation from wind farm will be taken as a base generation and the remaining demand will then be supplied from other regular generation plants under an optimized schedule.</p> <p>5.5 An SLG member asked for the next step of the project if proved not feasible and worthy in terms of cost, carbon reduction and energy output, and hence the tariff implications. The member emphasised the importance of controlling the efficiency of the project.</p> <p>5.6 Another SLG member asked if the CLP has done any comparison on the cost differences of constructing wind farm in China and different countries.</p> <p>5.7 The Chairman answered that the government will normally engage other consultants to benchmark the cost from overseas markets. CLP has also approached the potential turbine suppliers and will analyse the models available in the markets and the possible costs. The indicative notes, data and options collected, public views and tariff implications will also be considered during the process by CLP and government.</p> | |
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| | <p>5.8 Another SLG member stated that the construction of wind farm is principally in line with government's policy of having 1-2% renewable energy in the energy portfolio. Moreover, cost is not the only consideration; environmental and political issues should also be considered.</p> <p>5.9 An SLG member re-iterated the role of the SLG member, which is not to endorse the project, but to review and provide advice on Environmental Permit requirements, data collection, design, plan, and layout of the wind farm etc. The Facilitator agreed with the SLG member's point of view on the role of the SLG and reminded the SLG of their roles that were mentioned in the first SLG were as follows:</p> <p>5.10 The Facilitator explained that the Environmental Permit and SLG Terms of Reference indicate SLG advice into design, construction and operation of the possible OWF, such as the layout and number of wind turbines, exterior colour etc, comment on the marine geophysical survey, fisheries enhancement plan and landscape and visual intrusion plan, referenced in the Environmental Permit.</p> <p>5.11 An SLG member recapped on the maintenance works stating that the rough sea state and long down time in winter may affect the access and the maintenance works of the mast. The Chairman stated that preventive maintenance works would be done and checked in advance of the winter season for this reason.</p> | |
| <p>6.</p> | <p>Any Other Business</p> <p>6.1 The Chairman stated that the next SLG meeting will be in around 6 months later, with sharing of one-year full data gathered with experts to present the detailed findings to the SLG members.</p> <p>6.2 The SLG meeting closed at 16:30.</p> <p>Website: www.clp.com.hk/offshorewindfarm</p> | <p>Meeting minutes will be circulated among all SLG members for agreement, and posted on website within one month of the SLG meeting.</p> |