

**Hong Kong Offshore Wind Farm in South-eastern Waters  
Draft Minutes of the 7th Stakeholder Liaison Group (SLG) Meeting  
Held on 8<sup>th</sup> November 2013 from 2:30 pm to 4:45 pm in Arup's Hong Kong Office**

**Present:**

Ms. Ada CHAN (CLP Power) – Stakeholder Liaison Group Chairman  
 Prof. CHAN Lung-sang (HKU)  
 Dr. CHENG Luk-ki (Green Power)  
 Mr. CHENG King-man (Sai Kung Fishermen's Association)  
 Prof. Alexis LAU (HKUST)  
 Mr. LING Man Hoi (Member of Sai Kung District Council)  
 Mr. LOK Shui Sang (Sai Kung Rural Committee)  
 Mr. WONG Yung-Kan SBS JP (Representative from Agricultural & Fishery sector)

**Absent with Apologies:**

Ms. Gloria CHANG (Greenpeace)  
 Mr. Mike KILBURN (HK Bird Watching Society)  
 Prof. LAM Kit Ming (HKU)  
 Prof. NG Cho-nam (HKU)  
 Prof. Gerald PATCHELL (Friends of Sai Kung)  
 Dr. YAU Wing-kwong (Environmental Association Limited)  
 Mr. Frederick YU (Hong Kong Mountaineering Union)

Also present were SLG Facilitator Timothy J. Peirson-Smith, Alex Tancock of Wind Prospect, project consultants from Arup, an environmental consultant from ERM and CLP representatives

Ref No.	Issues/ Discussion	Follow-up Actions and Responsible by
1.	<p><b>Review of the 6<sup>th</sup> SLG meeting minutes</b></p> <p>1.1 The Facilitator began the 7th meeting by reviewing the SLG Team's actions from the 6th SLG meeting on 1<sup>st</sup> February 2013.</p> <p>1.2 The Facilitator went through the 6<sup>th</sup> SLG meeting minutes and confirmed that the following information would be presented in this meeting: 1) methodology used in hindcasting (<i>Ref. 3.3 of the 6<sup>th</sup> SLG minutes</i>), 2) power curve (<i>Ref. 3.6 of the 6<sup>th</sup> SLG minutes</i>), 3) findings on current</p>	

	<p>speed (<i>Ref. 3.13</i> of the 6<sup>th</sup> SLG minutes) and 4) further Meteorological Mast (Met Mast) data collection findings (<i>Ref. 4.2</i> of the 6<sup>th</sup> SLG minutes).</p> <p>1.3 The Facilitator asked for updates on follow-up actions regarding the installation of CCTV (<i>Ref. 2.19</i> of the 6<sup>th</sup> SLG minutes) and the monitoring of bird droppings (<i>Ref. 2.21</i> of the 6<sup>th</sup> SLG minutes). The Chairman stated this could be considered if the OWF received government's approval of the project.</p> <p>1.4 Regarding the monitoring of bird droppings, the Chairman reported that contractors had been instructed to take photos on the Met Mast, and only small amounts of bird droppings have been found on the Met Mast to date.</p>	
2.	<p>2.1 The Facilitator invited the Chairman to begin the presentation.</p> <p><b>Brief Review of Interim Findings presented in the 6<sup>th</sup> SLG Meeting</b></p> <p>2.2 The Chairman explained the technology used in wind data collection, such as cup anemometer, wind vane and LiDAR. The Chairman mentioned that LiDAR could be used to measure wind up to 200 m and up to 10 measurement levels.</p> <p>2.3 The Chairman stated the use of the Acoustic Doppler Current Profiler (ADCP) to measure wave height, sea level and current speed at different levels.</p> <p>2.4 The Chairman introduced the important parameters in wind data analysis, in addition to the monthly average wind speed, i.e. Wind Speed Frequency Distribution and Wind Rose, to understand the amount of time each wind speed will occur for energy assessment and the dominant wind direction for wind farm design.</p> <p>2.5 The Chairman explained the misalignment of wind and wave distribution (wind/wave misalignment), which will be an important consideration in the structural design of the wind farm.</p>	
3.	<p><b>Wind Data Collection and Energy Assessment Findings</b></p> <p>3.1 The Chairman introduced the procedures of wind resource assessment, and stated that Ground Investigation Data is needed for wind farm layout design.</p>	

<p>3.2</p> <p>3.3</p> <p>3.4</p> <p>3.5</p> <p>3.6</p> <p>3.7</p> <p>3.8</p> <p>3.9</p> <p>3.10</p>	<p>The Chairman presented the preliminary results of the 12-month Wind Data Collection at Met Mast from May 2012 to May 2013, and also the prediction on long term average wind speed using correlation.</p> <p>The Chairman explained that the wind consultant has recommended an extension of wind data collection to reduce the risk of data uncertainty due to possible seasonal bias of the shape of the wind rose.</p> <p>The Chairman stated that more Ground Investigation is required to finalise the layout design of the wind farm especially for suction can foundation.</p> <p>The Chairman stated that the installation of wind turbines could only be done between April and September to tie in with calmer sea state at the wind farm site location during this period. Therefore, if the wind farm confirms to go ahead , CLP will consider a two-stage development of the wind farm, of which 80-100 MW wind farm could be built at the first stage while the second stage will depend upon the experience from the first stage, market conditions and the technology available at that time.</p> <p>The Chairman reported the selection of the appropriate wind turbines and mentioned that the IEC Class 1 model is required due to the typhoon conditions in Hong Kong.</p> <p>At the Chairman's invitation Alex Tancock explained the power curve and wind speed frequency distribution used to estimate the energy output of the wind turbines.</p> <p>An SLG member asked if the power curve shown was only for one specific wind turbine model and if the number of wind turbines will be optimised at the wind farm. The Chairman replied in the affirmative.</p> <p>An SLG member asked if the wind turbines selected are able to withstand extreme weather conditions with reference to the recent strong Typhoon Usagi. The Chairman replied that the selected IEC class 1 model wind turbines were used overseas and could withstand extreme weather conditions of Hong Kong.</p> <p>An SLG member enquired about the data measured by LiDAR and asked the Wind Consultant to clarify the calculation of the Long Term Average Wind Speed, and specifically the value difference in the 13-year data and 5-month data, with the 20-year data. The Chairman stated that these differences would be further explained with data in the later part of presentation.</p>	<p>The chairman agreed to investigate and share findings at the 8<sup>th</sup> SLG.</p>
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	<p>3.11 The Chairman presented three scenarios of wind energy assessment for the offshore wind farm. An SLG member enquired on justifications on the 3 scenarios presented with different combinations of number of wind turbines and models. The Chairman replied that the 3 scenarios presented were examples and further studies would be carried out, as part of the feasibility study, to select an optimal model.</p>	
4.	<p><b>Met Mast Wind Data Analysis and Wind Farm Structural Design</b></p> <p>4.1 Wind Consultant presented the findings on the Met Mast Wind Data Analysis and Wind Farm Structural Design.</p> <p>4.2 The Wind Consultant introduced the locations of the different wind sensors on the Met Mast, comparison between the sets of data collected with LiDAR and cup anemometers on the Met Mast, and between those collected at the Met Mast and Waglan Island.</p> <p>4.3 The Wind Consultant explained the Extreme Wind Speed Analysis for the Structural design of the wind turbines. Different methods, such as Gumbel and XIMIS, could be used to predict extreme wind speed. The next step would be to discuss with Buildings Department to adopt an appropriate wind speed standard for the use in the design. The design will be “fit for purpose” to suit the actual HK offshore environment and weather conditions which is in compliance with international standard and will not compromise any safety and quality requirements.</p> <p>4.4 The Wind Consultant recommended that the wind shear exponent of 0.11 should be adopted in the wind farm structural design, which is in compliance with the requirement of the Buildings Department and supported by the measured wind shear exponent from the Met Mast.</p> <p>4.5 An SLG member asked the Wind Consultant to explain the seemingly systematic discrepancies between the data from the cup anemometers and LiDAR, since the speed measured with LiDAR is consistently slightly higher than that with the cup anemometers from September to January, but the opposite in other months. The Consultant replied that data from cup anemometers is regarded to be more reliable and hence preferred in calculations, as LiDAR is a relatively new way of measuring wind speed. The Consultant added that LiDAR is used to collect more information on the change of wind speed at different heights. The result was used to compare with requirements of Buildings Department and requirements of Buildings Department will be adopted in the design as stated in section 4.4.</p>	

- 4.6 An SLG member questioned the differences between the wind speed measured with LiDAR and cup anemometers in May 2013. The Consultant stated that the wind speed measured with cup anemometers in May 2013 were only up to mid-May, thus affecting its monthly mean. However the Wind Consultant stressed that, generally the data measured with cup anemometers in all other months were very close to those measured with LiDAR.
- 4.7 An SLG member enquired on the reasons behind the systematic discrepancies found in the data measured with cup anemometers at higher speeds. The Wind Consultant stated that both the percentage of time with certain wind speeds and the long-term speed estimates are important, and these calculations are based mainly on the data measured with cup anemometers; the data measured with LiDAR is supplementary.
- 4.8 An SLG member enquired about the height of cup anemometers at Waglan Island. The Consultant stated that their height is 82.7m.
- 4.9 An SLG member stated that data collected on Waglan Island is higher than those measured at the Met Mast, which is contrary to the usual understanding that wind is not as strong in locations nearer to the coast as those at sea. Consultant advised that Waglan Island is located in open sea. Another SLG member suggested that the island topography could have a speed up effect accounting for the higher wind speed measured at Waglan.
- 4.10 An SLG member enquired if the trend of decrease in surface wind is considered in the feasibility study. The Wind Consultant replied that situations with stronger winds are selected for structural design analysis in the feasibility study, and added that the difference between using wind data from before year 2000 and those that came afterwards in analysis for the feasibility study is insignificant.
- 4.11 An SLG member commented that the average wind speed at the wind farm has a stronger effect on the amount of energy produced than typhoons in the area. The Wind Consultant further explained that data from the Met Mast (correlated with Waglan Hong Kong Observatory historical data) will be used in estimating the amount of energy produced, whereas data from Waglan Island (which is the source wind data used to develop the Code of Practice on Wind Effects in Hong Kong) will be used in calculations for the structural design of the wind farm.
- 4.12 An SLG member was concerned that even a small drop in wind speed can significantly affect the amount of energy produced at the wind farm. The Wind Consultant replied that the historical trend of wind speed had shown a pattern of long term cycles with increasing and decreasing of

	<p>wind speed in between. They had discussions with the Hong Kong Observatory previously and both parties agreed that although a decrease in wind speed is the current trend noticed at present, the trend was inconclusive. The Wind Consultant added that the energy production of the wind farm should be more prudent to accommodate future changes in wind speed. The Chairman supplemented that the Wind Consultant had suggested extending the period for measuring wind data to understand the trend of wind speed changes as part of the feasibility study.</p>	
5.	<p><b>Wave Data Collection and Preliminary Findings</b></p> <p>5.1. The Wave Consultant summarised the collection of wave data, and stated that wave data collection was disrupted in July 2012 and February-March 2013 because of a typhoon and cable damage, respectively.</p> <p>5.2. The Wave Consultant stated the wind/wave misalignment, variation of water depth throughout the wind farm, tide level variation, soil conditions and normal and extreme wave conditions are the key design parameters of offshore wind farm.</p> <p>5.3. The Wind and Wave Consultants reported that the wind turbine supplier had recommended extending the wind/wave data collection period in order to collect more data on wind/wave misalignment for a more prudent structural fatigue design.</p> <p>5.4. The Wave Consultant reported the updated findings on the wave, current and sea level.</p> <p>5.5. An SLG member asked the Wave Consultant to clarify on the low depth averaged current speed collected from ADCP from 10 May- 9 July 2013. The Wave Consultant stated that there might be a discrepancy in the data collection. The Chairman added that maintenance was required and was carried out in June 2013.</p> <p>5.6. An SLG member enquired how much in the design of the wind farm would be changed if the Government approved the project. The Consultant replied that the project is still at an initial feasibility stage and more data on wind and waves is needed in order to fine tune the layout of the wind farm.</p>	

	<p>5.7. An SLG member questioned the accuracy of the wave data collected during a typhoon since the waves recorded was quite low. The Wave Consultant responded that the wave data during a typhoon is only used for calibration of a wave hindcast model. The actual design wave will be determined by the calibrated hindcast model using the worst historical typhoon tracks.</p>	
6.	<p><b>Project Optimisation and Feasibility Study Update</b></p> <p>6.1. The Engineering Consultant for foundation showed a brief video on the fabrication, transportation and installation of a concrete suction foundation of the wind farm, which demonstrated that the structure could be towed out and sunk down to the seabed using a semi-submersible barge, which could lower the project cost.</p> <p>6.2. Regarding the turbine installation vessel, the Chairman pointed out that using third generation Turbine Installation Vessels can help in wind farm cost optimisation, as advised by the installation vessel supplier in the PRC.</p> <p>6.3. Regarding the optimisation of the wind farm layout, the Wind Consultant stated that more wind data would be collected, which could be used to determine the wind rose more precisely for wind farm energy output optimization.</p> <p>6.4. An SLG member enquired if the design of the foundation had been changed, specifically regarding the number of suction cans. The Engineering Consultant replied that only one design was shown in the video and it is one of the options for optimising the project.</p> <p>6.5. An SLG member requested more information on the concrete suction caisson foundation, such as the diameter of the suction caisson. The Engineering Consultant stated the diameter of the suction can as 35 m.</p> <p>6.6. An SLG member requested more data on the foundation construction method with a single suction caisson. The Engineering Consultant replied that more information would be provided in future.</p> <p>6.7. An SLG member asked about the time needed to tow the suction caissons to the site of the wind farm and its effect on the water traffic of Sai Kung. The Engineering Consultant stated that it would take a day to tow the foundation from Dongguan to the site of the wind farm. The Chairman added that the time needed for installing concrete suction caissons is similar to that of steel suction caissons.</p>	<p>Further information on different options of construction will be shared in the future meetings.</p>

	<p>6.8. An SLG member was concerned that the concrete suction caisson foundation would bring severe impacts on the seabed. The Environmental Consultant pointed out that, if there are any changes in the design of the suction caissons, a Variation of Environmental Permit may have to be submitted to prove no material change in environmental impacts comparing with the steel caisson.</p> <p>6.9. An SLG member was concerned that change of suction caisson foundation may have impact on the wind farm area. The Engineering Consultant responded that while there might be changes in the number of wind turbines, the total area of the wind farm would not be changed. The Engineering Consultant also stated that the impact of the different combinations of the wind turbine foundation and number of turbines would have to be evaluated.</p> <p>6.10. An SLG member opined that there would be less impact on the livelihood of fishermen if there were less impact on the seabed brought by the wind farm. The Environmental Consultant responded that impact on fisheries was one of the considerations in the wind farm design. There is also a fisheries enhancement study element of the feasibility study which would be shared with future SLG meetings.</p>	
7.	<p><b>Next Steps</b></p> <p>7.1. The Chairman reported that wave data collection was disrupted in July 2012 by a typhoon and the measurement equipment was damaged in February-March 2013. Further wind and wave data collection needs to be extended complement the current data, as recommended by both the Wind Consultant and the wind turbine supplier.</p> <p>7.2. The Chairman proposed that further project optimisation studies would be conducted, such as evaluation on the suitability of concrete suction caisson foundation design and fisheries enhancement study.</p> <p>7.3. The Chairman mentioned the Hong Kong Government will conduct the Public Consultation on Fuel Mix before the end of 2013, and stated that the way forward of the wind farm project will depend on the approval from the Government and the public consensus.</p> <p>7.4. An SLG member opined that public opinion on the wind farm, especially from those residents who live in areas that might be affected by the wind farm, could be sought at the same time of the Government's Public Consultation on Fuel Mix.</p>	<p>The Chairman offered to share the updated data on wind and waves at the next 8<sup>th</sup> SLG meeting.</p> <p>The Chairman offered to share updated information on the optimisation studies at the next SLG meeting and fisheries enhancement study at an appropriate future SLG meeting.</p> <p>The Chairman will consider the SLG's request for engagement at later project</p>

	<p>7.5. An SLG member enquired about the period in which additional wind data will be measured. The Chairman replied that wind and wave data will be measured continually until February-March 2014, and will then be reviewed by the Consultant on adequacy of the data collected.</p> <p>7.6. An SLG member opined that more research on the impact of the wind farm project on local residents should be done. The Environmental Consultant expressed that the Environmental Impact Assessment (EIA) of the wind farm project had already been approved by the Government, and fisheries enhancement study will be carried out as required under the EIA, and this would be shared at an appropriate future SLG meeting.</p> <p>7.7. An SLG member expressed that many local stakeholders are concerned about the impact of the wind farm project on the natural landscape of the area. The Environmental Consultant replied that these issues were thoroughly discussed at earlier SLGs.</p> <p>7.8. An SLG member suggested that more updates should be provided regarding the impact on birds in the area. The Environmental Consultant replied that these issues were thoroughly discussed at earlier SLGs. The Environment Consultant also added that more study, including that on night time activities of birds, would be done in this regard if the Government approves the wind farm project.</p> <p>7.9. An SLG member suggested sharing the project information with Sai Kung District Council at an appropriate time to enhance their understanding so as to facilitate timely project endorsement by the Council.</p>	<p>stages and will report decisions via subsequent SLG meetings.</p> <p>The Chairman stated that results from the discussions with the Consultant would be shared at the next 8<sup>th</sup> SLG meeting.</p> <p>The Chairman will consider the SLG's request for engagement at later project stages and will report decisions via subsequent SLG meetings.</p>
8.	<p><b>Any other business</b></p> <p>8.1. The Facilitator stated that the next (8<sup>th</sup>) SLG meeting will be held in summer 2014.</p> <p>8.2. The 7<sup>th</sup> SLG meeting closed at 4:45 pm.</p>	<p>Meeting minutes will be circulated among all SLG members for agreement, and posted on website within one month of the 7<sup>th</sup> SLG meeting. &lt; <a href="http://www.clp.com.hk/offshorewindfarm">www.clp.com.hk/offshorewindfarm</a> &gt;</p>