An Environment Study Of The Offshore Wind Farm in The Central Taiwan and The Planning of Fabrication Yard
Contents

The Situation of Offshore Wind farm in Taiwan

Environmental Conditions in Changhua Offshore

The planning of fabrication yard in Taichung Port

Brief Introduction of Sinotech Engineering Consultants, Ltd

2016/10/27
The first offshore wind turbine in Taiwan
SIEMENS 4MW
The Situation of Offshore Wind farm in Taiwan
Potential Wind Energy in Taiwan

- **Water depth: 5~20m**
  - Area: 1,779.2 km²
  - Total Potential: 9 GW
  - Exploitation: 1.2 GW

- **Water depth: 20~50m**
  - Area: 6,547 km²
  - Total Potential: 48 GW
  - Exploitation: 5 GW

- **Water depth > 50m**
  - Total Potential: 90 GW
  - Exploitation: 9 GW
The Project of Thousand Wind Turbines in Taiwan

• Targets
  ➢ Recently: 4 demonstration offshore wind turbines by 2016
  ➢ Medium: Offshore 520 MW by 2020
  ➢ Future: Offshore 3,000 MW by 2025, 4,000 MW by 2030

<table>
<thead>
<tr>
<th>Year</th>
<th>2013</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
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<tbody>
<tr>
<td></td>
<td>MW</td>
<td>WTs</td>
<td>MW</td>
<td>MW</td>
<td>MW</td>
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<tr>
<td>岸上</td>
<td>614</td>
<td>311</td>
<td>737</td>
<td>1,200</td>
<td>1,200</td>
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<tr>
<td>離岸</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>520</td>
<td>2,000</td>
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<tr>
<td>總風力發電裝置容量</td>
<td>614</td>
<td>311</td>
<td>737</td>
<td>1,720</td>
<td>3,200</td>
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Offshore Demonstration Incentive Program

In 2013.1.25, Energy of Bureau announced: Swancor (Formosa), Taiwan Generation (Fuhai) and Taipower got the license to exploit the demonstration wind Farm.

Fuhai Demonstration Case:
Location: Off the coast of Fangyuan Township, Changhua County
Offshore: 8~12 kilometers, water depth: 20~45 meters
WTs: 30 installed wind turbines
Capacity: About 120 MW

TPC Demonstration Case:
Location: West side sea area of Fangyuan Township, Changhua County
Offshore: 5~8 kilometers, water depth: 15~25 meters
WTs: 22~36 installed wind turbines
Capacity: About 108 MW

Formosa Demonstration Case:
Location: Off the coast of Zhunan Township, Miaoli County
Offshore: 1~5 kilometers, water depth: 15~30 meters
WTs: 32 installed wind turbines
Capacity: About 128 MW
Offshore Wind farm Development

In 2015.7.2 BoE Announced: 36 Potential Site’s Data
Sinotech’s Performance in OWF Development
Summary of TPC OWF Project (Phase I)

- Location: West side sea area of Fangyuan Township, Changhua County
- Water Depth: 18~28m
- Turbine Capacity: 3.6~6.0MW
- Total Capacity: 108~110MW

<table>
<thead>
<tr>
<th>Turbine Capacity</th>
<th>Number</th>
<th>Total Capacity</th>
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<tr>
<td>3.6 MW</td>
<td>30</td>
<td>108 MW</td>
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<tr>
<td>4 MW</td>
<td>27</td>
<td>108 MW</td>
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<tr>
<td>5 MW</td>
<td>22</td>
<td>110 MW</td>
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<tr>
<td>6 MW</td>
<td>18</td>
<td>108 MW</td>
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</table>
Summary of TPC OWF Project (Phase II)

- Location: West side sea area of Lukang Town, Changhua County
- Water Depth: 18~50m
- Turbine Capacity: 6.0~8.0MW
- Total Capacity: 900MW
Summary of CSC’s OWF Project

• Location: West side sea area of Dacheng Township, Changhua County
• Water Depth: 20~45m
• Turbine Capacity: 5.0~7.0MW
• Total Capacity: 500~700MW
Environmental Conditions in Changhua Offshore
Environmental Conditions in Changhua Offshore

Wind Speed & Direction

- Rose Map in Changjiang Power Plant Wind Tower Data
  - Direction: NNE, Average Speed: 8.27 m/s

- Extreme wind speed: 53.57 m/s

- Environmental Conditions in Changhua Offshore
  - Return 50 years
### Environmental Conditions in Changhua Offshore

#### Tidal Level Statistics

<table>
<thead>
<tr>
<th>Tidal level</th>
<th>Elevation (m) (TWVD 2001)</th>
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<tbody>
<tr>
<td>Highest High water level (HHWL)</td>
<td>+3.48</td>
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<tr>
<td>Mean High Water Spring (MHWS)</td>
<td>+2.56</td>
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<tr>
<td>Mean high Water (MHW)</td>
<td>+2.15</td>
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<tr>
<td>Mean Water Level (MWL)</td>
<td>+0.31</td>
</tr>
<tr>
<td>Mean Low Water (MLW)</td>
<td>-1.47</td>
</tr>
<tr>
<td>Mean Low Water Spring (MLWS)</td>
<td>-2.02</td>
</tr>
<tr>
<td>Lowest Low Water Level (LLWL)</td>
<td>-2.81</td>
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Environmental Conditions in Changhua Offshore

### Storm Surge Heights

<table>
<thead>
<tr>
<th>Return period (year)</th>
<th>Storm surge height (m)</th>
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<tbody>
<tr>
<td>5</td>
<td>0.636</td>
</tr>
<tr>
<td>10</td>
<td>0.837</td>
</tr>
<tr>
<td>20</td>
<td>1.030</td>
</tr>
<tr>
<td>25</td>
<td>1.091</td>
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<tr>
<td>50</td>
<td>1.276</td>
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<tr>
<td>100</td>
<td>1.456</td>
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</table>
Environmental Conditions in Changhua Offshore

The wave height of 0~1.5 meters of the year is about 44.86% with wave period between 5~7 seconds, and the wave height of 1.5~2.5 meters of the year is about 25.94% with wave period between 6~8 seconds. For the wave direction, it is mostly between NNE~NNW.
Wave Observation in Site

<table>
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<tr>
<th>Statistical parameter</th>
<th>September</th>
<th>October</th>
<th>Statistics</th>
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<tbody>
<tr>
<td>Maximum significant wave height (m)</td>
<td>12.94</td>
<td>6.25</td>
<td>12.94</td>
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<tr>
<td>Maximum mean period (sec)</td>
<td>10.1</td>
<td>8.3</td>
<td>10.1</td>
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<tr>
<td>Average significant wave height (m)</td>
<td>2.30</td>
<td>2.08</td>
<td>2.17</td>
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<tr>
<td>Average mean period (sec)</td>
<td>5.7</td>
<td>5.9</td>
<td>5.8</td>
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<tr>
<td>Dominant wave direction</td>
<td>NNE</td>
<td>NNE</td>
<td>NNE</td>
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</tbody>
</table>
Typhoon Wave Simulation
To simulate the extreme wave condition during the typhoon in project site, a wave numerical model (DHI SW model) with historical typhoon data between years of 1977 to 2016, are applied to module the wind-generated waves. Annual maximum method is used to analyze the extreme wave parameters, Hs and Tp, for different return periods.
Environmental Conditions in Changhua Offshore

Extreme Wave Parameters of Site ($H_{1/3}$)
Current Observation in Site

Current statistics of site show that the largest constituent is the "principal lunar semi-diurnal", also known as the M2 tidal constituent. The mostly current directions is NE - SW. The maximum current speed is over 2 knots.
Environmental Conditions in Changhua Offshore

- **Borehole**
  - **Onshore**
    Sandy Silt & Clayey Silt
  - **Offshore**
    Sandy Silt & Clayey Silt
The planning of fabrication yard in Taichung Port
Construction Port

The Export Ports in TAIWAN

Taipei Port
Keelung Port
Taichung Port
Hualien Port
Kaohsiung Port
Construction Port

- Bird View of Taichung Port
Construction Port

- Location: #5A, 5B in Taichung
Construction Port

- Design Drawing of 5A, 5B Berth

Completion date:
5A: 2018/12/31
5B: 2019/12/31
Onshore Terminal

The layout of development plan: STEP 1 (5A, 5B, & 4C)
The layout of development plan: Final (8, 7, 6, 5, 5A, 5B&4C)
Onshore Terminal

➢ Foundation Manufacture - 2 Factories

Load-out Berth
Jacket Storage Area
Brief Introduction of Sinotech Engineering Consultants, Ltd
Sinotech: Steadfastness and Expert Guidance

Sinotech, one of the most reputable engineering consulting firms in Taiwan, was spun off from the non-profit corporation Sinotech Engineering Consultants, Inc. (Sinotech Inc.), which was established and funded by various state enterprises under the Ministry of Economic Affairs in the 1970s. Sinotech offers all manner of engineering consulting services. Combining talented personnel and professional expertise, technology and wisdom, it has — via its insistence on meticulousness and precision — created models for engineering quality in such fields as soil and water conservation, geotechnical engineering, energy and electrical generation, industrial development, environmental protection, transportation, urban and rural infrastructure, and mechanical and electrical engineering. Under its corporate philosophy of “ethics and integrity, commitment to quality, pursuit of excellence, and creativity and innovation,” Sinotech has been continually pushing to raise the level of its expertise and professionalism in order to provide its clients with comprehensive services.
Division of Labor

Responsibility centers, concentrations of high-quality professionals
Scope of Services

Covering engineering lifecycle, providing full-spectrum services
Field of Activities

Responsibility Center for Water Resources and Power Development
Field of Activities

The Responsibility Center for Architecture and Civil Engineering
Field of Activities

Rail Engineering Responsibility Center
Field of Activities

Environmental, Mechanical and Electrical Engineering Responsibility Center
Thank you for your attention.