Promotion of Localization of Offshore Wind Industry Supply Chain

Chih-Ching Yang
Deputy Director General
Industrial Development Bureau, MOEA

April 25th, 2019
Outline

I. Overview of Offshore Wind Industry in Taiwan
II. Industry Localization: Target & Strategy
III. Industry Localization: Outcomes
IV. Conclusion
I. Global Offshore Wind Industry: Overview (1/4)

Global Offshore Wind Market Snapshot

Offshore Wind New Installed Capacity in 2018

- In 2018, global offshore wind capacity has grown to 4,351MW, a slight increase of 0.4% from 2017. Top 3 countries are China (38%), the UK (30.2%), and Germany (22.3%).

- Cumulative global offshore wind capacity in 2018 reached 23,218MW. The UK retained the top spot as the offshore wind powerhouse, with 35.2% market share, followed by Germany (27.5%).

- Top 5 turbine suppliers in 2018: Siemens Gamesa Renewable Energy (38%), MHI Vestas Offshore Wind (20.3%), Shanghai Electric (16.7%), Envision Energy (9.2%) and Goldwind (9.2%).

Source: GWEC 2018.4/CWEA/Wind Europe, compiled by MIRDC MII
The global offshore wind market is expected to grow at the **compound annual growth rate (CAGR) of 15.2% during 2019-2030**. The cumulative global capacity is predicted to reach **86GW** by **2025**, **142GW** by **2030**.

China, the UK and Germany will dominate the global market, while India, the US and **Taiwan are emerging markets with huge growth potential**.

Source: GWEC 2019.4/BNEF/compiled by MIRDC MII (2019.4)
I. Global Offshore Wind Industry: Overview (3/4)
Taiwan: Leading Offshore Wind Development in Asia-Pacific

- Total target capacity in Asia by 2030: **80-95GW**, fastest-growing region worldwide.
- With clear policy, complete infrastructure & regulations, Taiwan has become a pioneer in Asia offshore wind development.

**Fostering Local Supply Chains**

- Expand to APAC Market
  - Targets by Asia GOV:
    - **China 30GW**
    - **South Korea 12GW**
    - **Japan 3-4GW**
    - **India 30GW**
    - **Vietnam 3GW**

**New Installed Capacity/y (MW)**

- **34GW**

**Developers:**

1. **Ørsted** set up Asia-Pacific office in Taiwan as regional center and planned to launch green bonds
2. **Macquarie** will set up infrastructure fund to expand green energy investment in Taiwan
3. WPD, CIP, NPI view Taiwan as the 1st market in Asia for offshore wind development

**Turbine System Suppliers:** set up core component facilities to make Taiwan Asia-Pacific production base.

**Local Suppliers:**

1. build 4 major local supply chains: foundation, electrical facility, turbine & marine engineering
2. join in the global supply chain
I. Global Offshore Wind Industry: Overview (4/4)

4-year Wind Energy Development Plan (Approved by Executive Yuan in Aug, 2017)

**Enhance Energy Safety**
- Energy Self-sufficiency
- Energy Diversity

**Green Economy**
- Boost Domestic Demand & Employment
- Innovation, transformation for global market

**Sustainability**
- Save Energy & Reduce Carbon Emission
- Environment Protection

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**Cumulative capacity in 2025: 6.7 GW**

**Onshore**
- 2016 Target: 682 MW
- 2020 Target: 814 MW
- 2025 Target: 1,200 MW

**Offshore**
- 2016 Target: 8 MW
- 2020 Target: 520 MW
- 2025 Target: 5,500 MW

**Wind Energy Development**

**Office of Energy and Carbon Reduction, Executive Yuan**
- Help cross-offices coordination

**Onshore**
- Communicate With Public
- Feed Line Setting
- Wind Farm Location
- Coexist with Fishers
- Designated Dock
- Industry Park
- Installation Ships
- Better Regulation
- Spatial Co-competition
- Grid Connection

**Offshore**
- Coexist with Fishers
- Designated Dock
- Industry Park
- Installation Ships
- Better Regulation
- Spatial Co-competition
- Grid Connection

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II. Industry Localization: Target & Strategy (1/8)
Three-Phase Development Strategy

**Demonstration Incentive**: demonstration turbines (8 MW) completed in 2017 and 2 demonstration wind farms (230 MW) completed in 2020

**Potential Zones**: EIA* approved 10 GW in 2017; total capacity is predicted to be 5.5 GW in 2025

*EIA: Environmental Impact Assessment

**Demonstration Incentive**

- Provide incentive to help lower business risks
- First demo turbines (8 MW) completed in 2017
- Two demo wind farms to be completed by 2020 (230 MW)
  - Formosa @ Miaoli (120 MW, SGRE SWT-6.0-154*20)
  - Taipower @ Changhwa (109 MW, Hitachi 5.2MW*21)

**Potential Zone**

- 36 potential zones are announced.
- Suppliers are required to obtain:
  - EIA approval by 2017
  - Establishment permit by 2019
- EIA has approved: 20 projects (18 farms) ≈10 GW
- Capacity via Selection:
  - 2020: 0.738 GW
  - 2021-2025: 3.098 GW
- via Auction: 2025: 1.664 GW

**Zonal Development**

- Government does the whole planning, EIA process, and developer selection in order to save time and cost as well as establish local industry.
- Zones allotted no capacity are primary to be planned as wind farm block.
- Put factors such as industry, new technology into consideration.

### Potential Zones Announce Sites, Accept Application

- 36 potential zones are announced.
- Suppliers are required to obtain:
  - EIA approval by 2017
  - Establishment permit by 2019
- EIA has approved: 20 projects (18 farms) ≈10 GW
- Capacity via Selection:
  - 2020: 0.738 GW
  - 2021-2025: 3.098 GW
- via Auction: 2025: 1.664 GW
II. Industry Localization: Target & Strategy (2/8)

Conduct Industry Localization through Developers’ Commitment Statement

- Develop industry supply chains through market demand.
- Following Taiwan’s infrastructure project schedule, develop industry steadily and orderly.
- Set clear timeline to manage and develop effectively.
- Selection followed by auction, quality suppliers get priority.

**Capacity by 2025: 5.5 GW**

- **Selection**
- **Auction**

<table>
<thead>
<tr>
<th>Grid Connection by 2020</th>
<th>Grid Connection during 2021-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Allotted Capacity:</strong> 0.5 GW (0.738GW in reality)</td>
<td></td>
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<tr>
<td>Criteria:</td>
<td></td>
</tr>
<tr>
<td>technical capability (60%)</td>
<td></td>
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<tr>
<td>financial capability (40%)</td>
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<tr>
<td>Review the progress according to submitted documents when applying establishing permits.</td>
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</tr>
</tbody>
</table>

- **Allotted Capacity:** 3 GW (3.098GW in reality)
- Criteria: technical capability & financial capability
- Commitments required:
  - Specific industrial relevance program: for 2021-2022 period, by Nov 15th, 2018; for 2023-2025 period, by Nov 15th, 2019
  - Use best available techniques & strategy to lower environmental impact
  - Use Power Development Fund for environmental protection & CSR* projects

- **Allotted Capacity:** 2 GW (1.664GW in reality)
- 2-stage evaluation:
  - Qualification: a score higher than 60 in the selection process.
  - Parties with lower FIT rates are selected.
- Requirements for 2021-2025 projects are more flexible.

*CSR: Corporate Social Responsibility
*FIT: Feed-In Tariff

Source from BOE
## II. Industry Localization: Target & Strategy (3/8)

### Industrial Relevance Program required for 6 Developers according to Selection Results & Grid Connection Timeline

<table>
<thead>
<tr>
<th>Order</th>
<th>Project</th>
<th>Developer</th>
<th>Capacity Applied (MW)</th>
<th>Capacity Allotted</th>
<th>Year of Connection</th>
<th>Point of common coupling</th>
<th>Accumulated capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Liwei</td>
<td>WPD(1)</td>
<td>363</td>
<td>350</td>
<td>110</td>
<td>Tangwei D/S</td>
<td>350</td>
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<tr>
<td>2</td>
<td>Changhwa south-east</td>
<td>Ørsted(2)</td>
<td>605.2</td>
<td>605.2</td>
<td>110</td>
<td>Changhwa I(A)</td>
<td>955.2</td>
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<tr>
<td>3</td>
<td>Yun-neng</td>
<td>WPD(1)</td>
<td>348</td>
<td>348</td>
<td>110</td>
<td>Taishi D/S</td>
<td>1,303.2</td>
</tr>
<tr>
<td>4</td>
<td>Changhwa south-west</td>
<td>Ørsted(2)</td>
<td>631.9</td>
<td>294.8</td>
<td>110</td>
<td>Changhwa I(A)</td>
<td>1,598</td>
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<tr>
<td>5</td>
<td>Changfang</td>
<td>CIP(3)</td>
<td>552</td>
<td>452</td>
<td>112</td>
<td>Changhwa I(B)</td>
<td>2,150</td>
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<tr>
<td>6</td>
<td>Zhongneng</td>
<td>CSC(4)</td>
<td>480</td>
<td>300</td>
<td>113</td>
<td>Changhwa I(B)</td>
<td>2,450</td>
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<tr>
<td>7</td>
<td>West Island</td>
<td>CIP(3)</td>
<td>400</td>
<td>48</td>
<td>113</td>
<td>Changhwa I(B)</td>
<td>2,498</td>
</tr>
<tr>
<td>8</td>
<td>Changhwa north-east</td>
<td>Ørsted(2)</td>
<td>560.7</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>2,498</td>
</tr>
<tr>
<td>9</td>
<td>Taipower</td>
<td>Taipower(5)</td>
<td>720</td>
<td>300</td>
<td>113</td>
<td>Changhwa I(B)</td>
<td>2,798</td>
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<tr>
<td>10</td>
<td>HaiLong II</td>
<td>NPI(6)</td>
<td>532</td>
<td>300</td>
<td>113</td>
<td>Changhwa I(B)</td>
<td>3,098</td>
</tr>
</tbody>
</table>

Industrial Relevance Program submitted by Nov 15th, 2018

Industrial Relevance Program submitted by Nov 15th, 2019
II. Industry Localization: Target & Strategy (4/8)

**Goal**
Drive industry growth; build supply chain; battle the Asia-Pacific market share

**Strategy**

1. **Building infrastructure for industrial development:** establish industrial parks, drive business investment and create industrial clusters
2. **Establishing industrial supply chains:** attract international wind industry manufacturers with market incentives, help domestic suppliers (wind turbine, foundation and marine engineering ships) build partnership foreign suppliers to form industry supply chains.

- International cooperation
- Development of key subsystems & parts
- Help create successful domestic wind farm cases
- Expand to Asia-Pacific market and break into global supply chain
- Infrastructure for industry development
- Industrial parks and Industrial clusters
- Attract international businesses to invest and set up factories in Taiwan
- Strengthen matching mechanisms
II. Industry Localization: Target & Strategy (5/8)

Strategy for Sustainable Offshore Wind Industry

Sustainable, Stable Market
✓ Demonstration Incentive
✓ Potential Zone
✓ 10-year Zonal Development Policy

Promoting Industrialization of
✓ Wind farms in preparation stage
✓ Auction-determined wind farms
✓ Zonal Development

Reasonable FIT Rate
✓ Domestic status is in infancy
✓ Asia-Pacific supply chains is in primary stage
✓ Different conditions by countries
## II. Industry Localization: Target & Strategy (6/8)

### Local Supply Chain of Turbine Components

- Local suppliers with success records in manufacturing components such as fasteners, towers, castings, blade resin for **onshore turbines**
- Following the policy, CSC helped established **Wind-Team**, an industry alliance, with > 60 local suppliers

<table>
<thead>
<tr>
<th>Item</th>
<th>Tier 1 Alliance Supplier</th>
<th>Tier 2 Alliance Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation</td>
<td>Steelcomp, CSMC</td>
<td>MRY, CSMC, CSBC, FHI, CTCI, HKS, Rong Sheng Mechanical Engineering, Cheng Jan, Wanchi Steel, CSSC, CSAC, Fer-Mo</td>
</tr>
<tr>
<td>Tower</td>
<td>CSWIND/ Chin Fong</td>
<td>CSC,</td>
</tr>
<tr>
<td>Nacelle Assembly</td>
<td>MVOW &amp; TECO</td>
<td>-</td>
</tr>
<tr>
<td>Transformer</td>
<td>Shihlin Electric engineering, Fortune Electric, Allis Electric</td>
<td>Tong Cheng, Zu San Precision Machinery, Chung Long Precision Machinery</td>
</tr>
<tr>
<td>Switchboard</td>
<td>Tatung, Shihlin Electric, Allis Electric, Nan Ya Plastics</td>
<td>-</td>
</tr>
<tr>
<td>UPS</td>
<td>Delta Group</td>
<td>CSCC, Yung Loong Engineering, Molicel, Inner-Energy Technology</td>
</tr>
<tr>
<td>Spinner Cover</td>
<td>Atech Composites</td>
<td>Swancor, Formosa Plastics, Taiwan Glass</td>
</tr>
<tr>
<td>Cable</td>
<td>Taya Group, Walsin Lihwa</td>
<td>Sinbon Electronics</td>
</tr>
<tr>
<td>Hub Casting</td>
<td>YGG, Cheng Sheng Metal</td>
<td>-</td>
</tr>
<tr>
<td>Fastener</td>
<td>Boltun Corporation, Chun Yu Group</td>
<td>CSC, Azurewave Technology, Spring Profit, A-OKAY</td>
</tr>
<tr>
<td>Gearbox</td>
<td>FHI</td>
<td>Nan Lung Steel, S.K, Chen Lin, Cheng Sheng Metal</td>
</tr>
<tr>
<td>Generator</td>
<td>TECO, Tatung</td>
<td>CSC, Himag Magnetic, MagnPower</td>
</tr>
<tr>
<td>PCS</td>
<td>Delta Group</td>
<td>-</td>
</tr>
<tr>
<td>Blade/ Carbon Fiber</td>
<td>Tien-Li</td>
<td>Swancor, Formosa Plastics, Taiwan Glass</td>
</tr>
<tr>
<td>Nacelle Cover</td>
<td>Atech Composites</td>
<td>-</td>
</tr>
<tr>
<td>Nacelle Chassis Casting</td>
<td>YGG, Cheng Sheng Metal, Yuan Jun Fong Casting</td>
<td>Swancor, Formosa Plastics, Taiwan Glass</td>
</tr>
<tr>
<td>PCM</td>
<td>TECO</td>
<td>-</td>
</tr>
<tr>
<td>Yaw System</td>
<td>Solpower, TECO, Delta Group</td>
<td>TECO, FHI</td>
</tr>
<tr>
<td>Pitch System</td>
<td>JUFAN</td>
<td>Tongyou, Golden Asia, Parjet Co, Yi-yi, Yun Hung</td>
</tr>
</tbody>
</table>
## II. Industry Localization: Target & Strategy(7/8)

### Industry Development Objectives & Timetable

With local technical readiness & international experience considered

<table>
<thead>
<tr>
<th>Year of grid connection</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase</td>
<td>Pre-Stage</td>
<td>Pre-Stage</td>
<td>Phase 1</td>
<td>Pre-Stage</td>
<td>Phase 2</td>
</tr>
<tr>
<td>Key Items</td>
<td></td>
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</tr>
<tr>
<td>Tower</td>
<td></td>
<td></td>
<td>Turbine component: nacelle assembly, transformer, switchboard, UPS, spinner cover, cables, hub casting, fastener</td>
<td>Turbine component: gearbox, generator, PCS, blade and resin, nacelle cover, nacelle chassis casting</td>
<td></td>
</tr>
<tr>
<td>Foundation</td>
<td></td>
<td></td>
<td>underwater cables</td>
<td>Marine Engineering planning, design, construction, supervision, and manufacturing:</td>
<td></td>
</tr>
<tr>
<td>Electrical Components:</td>
<td></td>
<td></td>
<td>1. Construction and supervision of tower, foundation, etc. Ship and machine tool planning design and safety management (BOE)</td>
<td>Marine Engineering planning, design, construction, supervision, and manufacturing:</td>
<td></td>
</tr>
<tr>
<td>1. Transformer</td>
<td></td>
<td></td>
<td>2. Ship building: an industrial supply chain for new or retrofitted installation ships (including the ships for transportation and construction) (IDB)</td>
<td>Construction and supervision of wind turbines and other parts. Ship and machine tool planning design and safety management. (BOE)</td>
<td></td>
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<tr>
<td>2. Switchgear</td>
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<tr>
<td>3. Switchboard</td>
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<tr>
<td>The above are on-shore</td>
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<tr>
<td>power equipment.</td>
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<tr>
<td>Marine engineering</td>
<td></td>
<td></td>
<td></td>
<td>Pre-Stage items for 2021 &amp; 2022</td>
<td>Pre-Stage items for 2021 &amp; 2022</td>
</tr>
<tr>
<td>planning, design,</td>
<td></td>
<td></td>
<td></td>
<td>Phase 1 items for 2023</td>
<td>Phase 1 items for 2023</td>
</tr>
<tr>
<td>construction, supervision, and manufacturing:</td>
<td></td>
<td></td>
<td></td>
<td>Phase 2 items for 2024</td>
<td>Phase 2 items for 2024</td>
</tr>
<tr>
<td>1. Construction and supervision of surveying, cable laying, exploration, etc. Ship and machine tool planning design and safety management (BOE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Ship building: an industrial supply chain for new or retrofitted installation ships (including the ships for surveying, support, seabed preparation, transportation and cable laying.) (IDB)</td>
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</table>

(Note: The grid connection schedule announced by the Energy Bureau shall prevail)
Ensure Implementation of Industrial Relevance Programs

Beforehand Review
- 「Review Directions for the Offshore Wind Power Industrial Relevance Program」 announced in Nov, 2018

Continuous Efforts
- Promote the collaboration between developers and local businesses.
- Build industry supply chain for the global market.

Afterwards Inspect
- Ensure developers implementing Industrial Relevance Programs.
- Give assistance to local suppliers in technical upgrading & transformation.
III. Industry Localization: Outcomes (1/7)

**Offshore Wind Turbine Component**

### Pre-stage Items
- **Tower**: CS WIND & Chin Fong Machine formed partnership at Taichung Harbor, have signed tower supply agreement with SGRE & MVOW.

### Phase I Items
- **Casting**: YGG have signed an MOU with SGRE.
- **Spinner cover, nacelle cover**: Jupiter Bach is going to build a factory in Kaohsiung with Atech Composites, and have signed an MOU for nacelle composites with SGRE.
- **Cable**: SGRE signed high-voltage cable MOU with Walsin Lihwa, and low-voltage cable MOU with Sinbon Electric, Walsin Lihwa & TA YA Group.

### Phase II Items
- **Generator**: TECO signed generator MOU with MVOW, and yaw motor MOU with SGRE.
- **Blade**
  - MVOW signed MOU with Tien-Li, Swancor (resin), Formasa Plastics (carbon fiber) and so on.
  - Tien-Li concluded leasing process for land in Taichung Port in order to invest 3 billion NTD on turbine blade factory.
  - SGRE signed contract with Swancor for supplying blade resin at Formosa II.
III. Industry Localization: Outcomes (2/7)

Electrical Facility

Ørsted

• Deal with Taiwan Cogen for onshore transmission & substation EPC contract for offshore wind farm (including onshore cables & culvert)
• Purchase all electrical & mechanical equipment parts of onshore substations through Taiwan Cogen’s subsidiary Star Energy.

Copenhagen Infrastructure Partners

Four qualified suppliers are firstly selected: Chung-Hsin Electric and Machinery (CHEM), Fortune Electric (FE), PECL, CTCI; Transformer: Tatung, FE; Switchgear: CHEM, TECO; Switchboard: FE, Tatung, Shihlin Electric, Allis Electric, TECO.

WPD

EPC engineering is conducted by GE, who purchases components locally, including transformers (FE, Tatung), switchgear (CHEM, FE) and switchboard (FE).
III. Industry Localization: Outcomes (3/7)

**Foundation**

**Century Bladt Foundation Co**
- Established due to joint venture of Century Wind Power (CWP) & Danish supplier Bladt. Having invested 5 billion NTD on Taipei Harbor facility.
- Contracting with Ørsted for 90 million NTD of jacket foundation TP mock-up, which is 1st Taiwan contract of offshore wind industry.
- Contracting with CIP for 16.5 billion NTD of foundation supply for Changfang & West Island wind farms.
- Contracting with WPD for 87 monopile foundations for Liwei wind farm.

**Tai-Shing Century Wind**
- Investing 3.3 billion NTD for foundation TP factory at Taichung Port.

**CSC subsidiary Sing Da Marine Structure Corporation**
- Contracting with Ørsted to supply 56 foundations (central column & TP).

**Front-end Offshore Wind Facility Manufacturing Co**
- HKS Steel & CT invested 1.2 billion NTD for steel pin-pile factory.

**FHI (Formosa Heavy Industry)**
- FHI supplies 69 pin-piles for Changhua SE & SW wind farms under the contract with Ørsted for 2 billion NTD.

**CSBC (China Shipbuilding Corporation)**
- CSBC supplies 60 pin-piles for Changhua SE & SW wind farms under the contract with Ørsted.
III. Industry Localization: Outcomes (4/7)

Ship Engineering & Shipbuilding

Survey/ support vessel

- WPD and EGST signed contract on survey vessels for offshore wind farms.
- For sea floor survey vessels, Ørsted contracted with Dragon Prince for 150 million NTD for site investigation.

Transfer vessel

- The crew transfer vessel of TIPC Marine Co, is built by LUNG TEH Shipbuilding and priced at 125 million NTD, enabled since July 27th, 2018.
- The second one is under construction.

Cable-laying vessel

- Ørsted signed 1 billion NTD cable laying contract with Woen-Jinn. New vessels is scheduled to be enabled at Q1, 2020.

Transport & installation vessel

- CSBC invested 700 million NTD on 140m large barges for transporting foundations, planned to be completed in May, 2019.
III. Industry Localization: Outcomes (5/7)

2018-11-22 Economic Daily News
Kaohsiung Offshore Wind Supply Chain /
Wang: foundation production will start at the end of next year (2019)

Ya-Chou Wang, Chairman,
Sing Da Marine Structure Corporation
III. Industry Localization: Outcomes (6/7)

- According to Wang, CSC was selected as the contractor for the development and operation of the “Marine Engineering Area of Kaohsiung Marine Technology Industrial Innovation Zone”. **6.84 billion NTD** will be invested **in building facility for jacket foundations**, which will **operate at the end of 2019, with an annual production of 50 jackets**.
- A jacket is composed of several key components such as TP, node, legs, bracing system and stabbing pin, which are manufactured by different suppliers and then assembled and coated at SDMS’s facility.
- To ensure the stability of component supply during production, 3 approaches are adopted. 
  1. Find **at least 2 suppliers for each key component** for flexible production.
  2. **Assess suppliers’ producing ability, provide training if needed, conduct evaluation, and offer guidance in view of systems and technology.**
  3. Perform **trial production of core components** to ensure suppliers’ ability.
- All suppliers can participate in the trial production to gain experience. **Nervión, as a technical business partner, shares experience & technique with the suppliers**, and offers on-site assistance. **We should be open-minded** when entering uncharted territories. The experienced international experts and strategic partners could help us to analyze our ability and fill the gap.
III. Industry Localization: Outcomes (7/7)

• SDMS, CSMC and CSSC sent more than 20 staff to Nervión for technical training, which covers quality control, production, wielding, design, project management, EHS, supply chain, production & material management, sand blast, coating, to set SOP and SIP for future foundation production at SDMS.

• Learning from DNV-GL, which has proud outcomes in offshore wind project management worldwide, and employ their personnel to support project management in Q1, 2019.

• SDMS got the first jacket foundation order for Taiwan market from Ørsted, which is key for advancing its technique and experience. The order also compensates the production capacity for the first two years. Ørsted pledged to offer continuous technical support to help SDMS be competitive in quality, cost and delivery (QCD). Hopefully, Ørsted and CSC group can build lasting partnership to develop Taiwan wind farms, and take up Asia-Pacific market.
What We Pursue

• Industry Upgrading
• Industry Transformation
• Industry Innovation

IV. Concluding Remarks (1/3)
IV. Concluding Remarks (2/3)

Industry Development Focus: Independent Tech Innovation

<table>
<thead>
<tr>
<th>Year of grid connection</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
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<tbody>
<tr>
<td>Phase</td>
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<td>Pre-Stage</td>
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<tr>
<td>Tower</td>
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<tr>
<td>Foundation</td>
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<tr>
<td>Electrical Components:</td>
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<tr>
<td>1. Transformer</td>
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<tr>
<td>2. Switchgear</td>
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<tr>
<td>3. Switchboard</td>
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<td>The above are on-shore</td>
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<td>power equipment.</td>
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<td>Marine engineering</td>
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<td>planning, design,</td>
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<td>construction,</td>
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<td>supervision, and</td>
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<td>manufacturing:</td>
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<td>1. Construction and</td>
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<td>supervision of</td>
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<td>surveying, cable laying,</td>
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<td>exploration, etc. Ship</td>
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<td>and machine tool</td>
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<td>planning design and</td>
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<td>safety management.</td>
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<td>(BOE)</td>
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<td>2. Ship building:</td>
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<td>an industrial supply</td>
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<td>chain for new or</td>
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<td>retrofitted installation</td>
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<td>ships (including ships</td>
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<td>for surveying, support,</td>
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<td>laying.) (IDB)</td>
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</table>

**Key Items**

**Pre-Stage Items for 2021**

- Turbine component: nacelle assembly, transformer, switchboard, UPS, spinner cover, cables, hub casting, fastener
- underwater cables
- Marine Engineering planning, design, construction, supervision, and manufacturing:
  1. Construction and supervision of tower, foundation, etc. Ship and machine tool planning design and safety management (BOE)
  2. Ship building: an industrial supply chain for new or retrofitted installation ships (including ships for surveying, support, seabed preparation, transportation and cable laying) (IDB)

**Pre-Stage items for 2021 and 2022**

- Turbine component: gearbox, generator, PCS, blade and resin, nacelle cover, nacelle chassis casting
- Marine Engineering planning, design, construction, supervision, and manufacturing: Construction and supervision of wind turbines and other parts. Ship and machine tool planning design and safety management. (BOE)

**Pre-Stage items for 2021 & 2022**

- Phase 1 items for 2023
- Phase 2 items for 2024

(Note: The grid connection timeline consistent with BOE announcement.)
## IV. Concluding Remarks (3/3)

### Ongoing Review of Submitted Industrial Relevance Programs

<table>
<thead>
<tr>
<th>Order</th>
<th>Project</th>
<th>Developer</th>
<th>Capacity Applied (MW)</th>
<th>Capacity Awarded</th>
<th>Year of Connection</th>
<th>Point of common coupling</th>
<th>Accumulated capacity (MW)</th>
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<tbody>
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<td>Yun-neng</td>
<td>WPD(1)</td>
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<td>348</td>
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<td>5</td>
<td>Changfang</td>
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<td><strong>48</strong></td>
<td>113</td>
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<td>9</td>
<td>Taipower</td>
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<td><strong>300</strong></td>
<td>113</td>
<td>Changhwa I(B)</td>
<td>3,098</td>
</tr>
</tbody>
</table>

*Industrial Relevance Program submitted by Nov 15th, 2018*
Thank you.