離岸風電港口基礎建設規劃-以臺中港為例

Port Infrastructure and Construction in Taiwan -Taichung Port

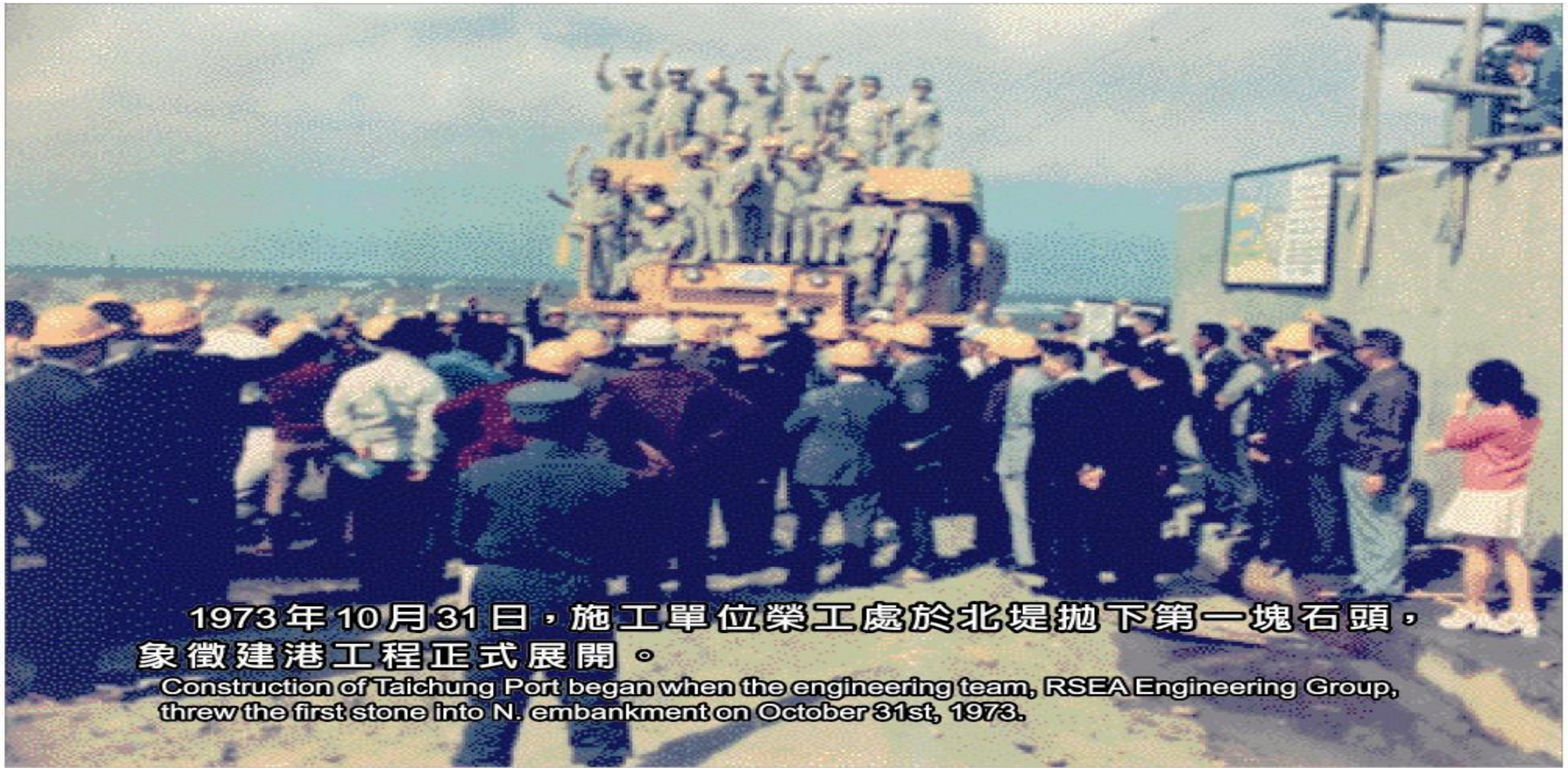
Irene Tang

Senior Director of New Business Dept, TIPC

Oct 13th, 2020

In the year of 1945

Ten Major Construction Projects

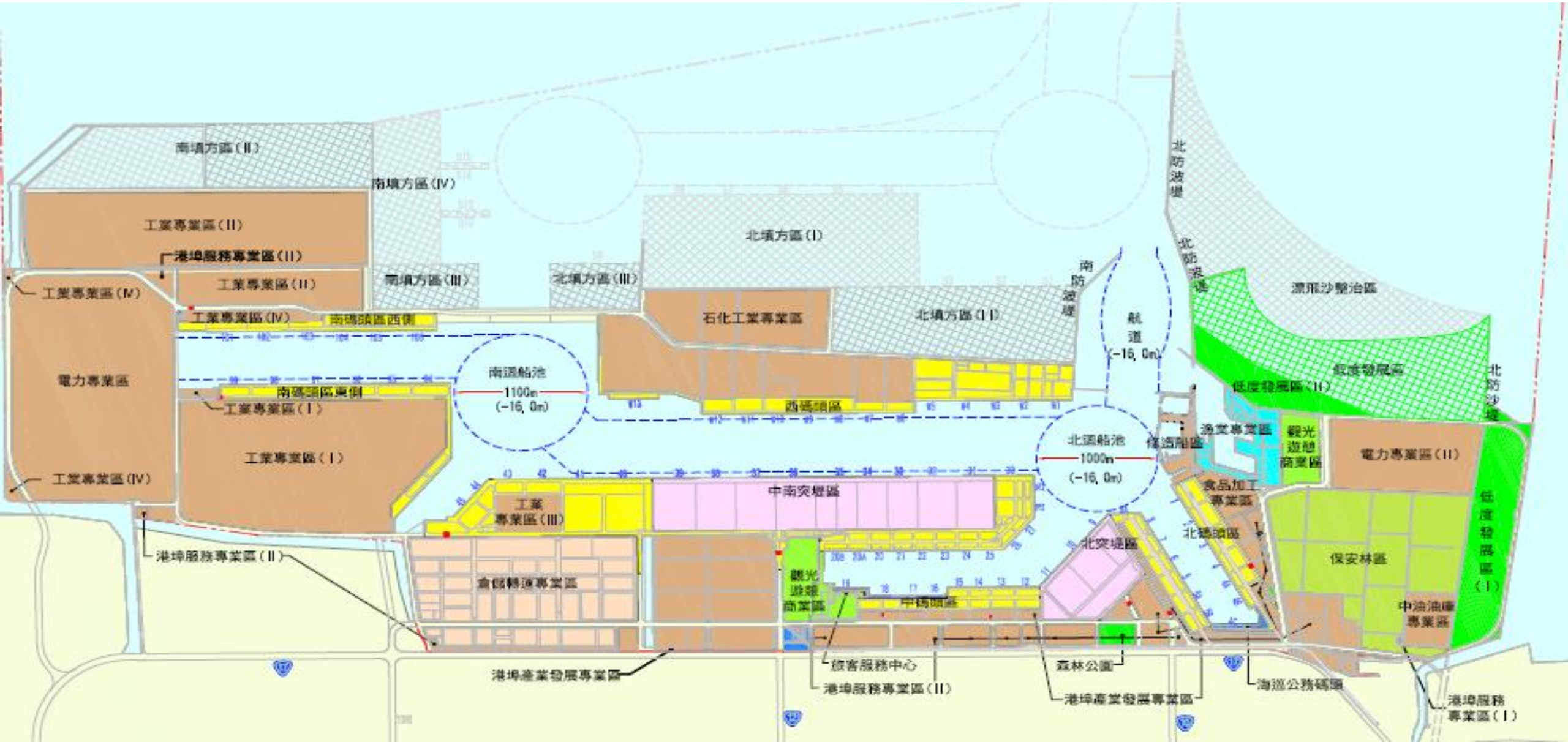



先總統蔣經國先生平易近人，視察建港工程時於工地與榮民一起工作。
Ex-president Jiang Jing-guo was joining the veterans to share their hard works when he checked the engineering work of the port under way. Mr. Jiang jr. had a personality of friendliness with the public.

Operation on Oct 31,1976

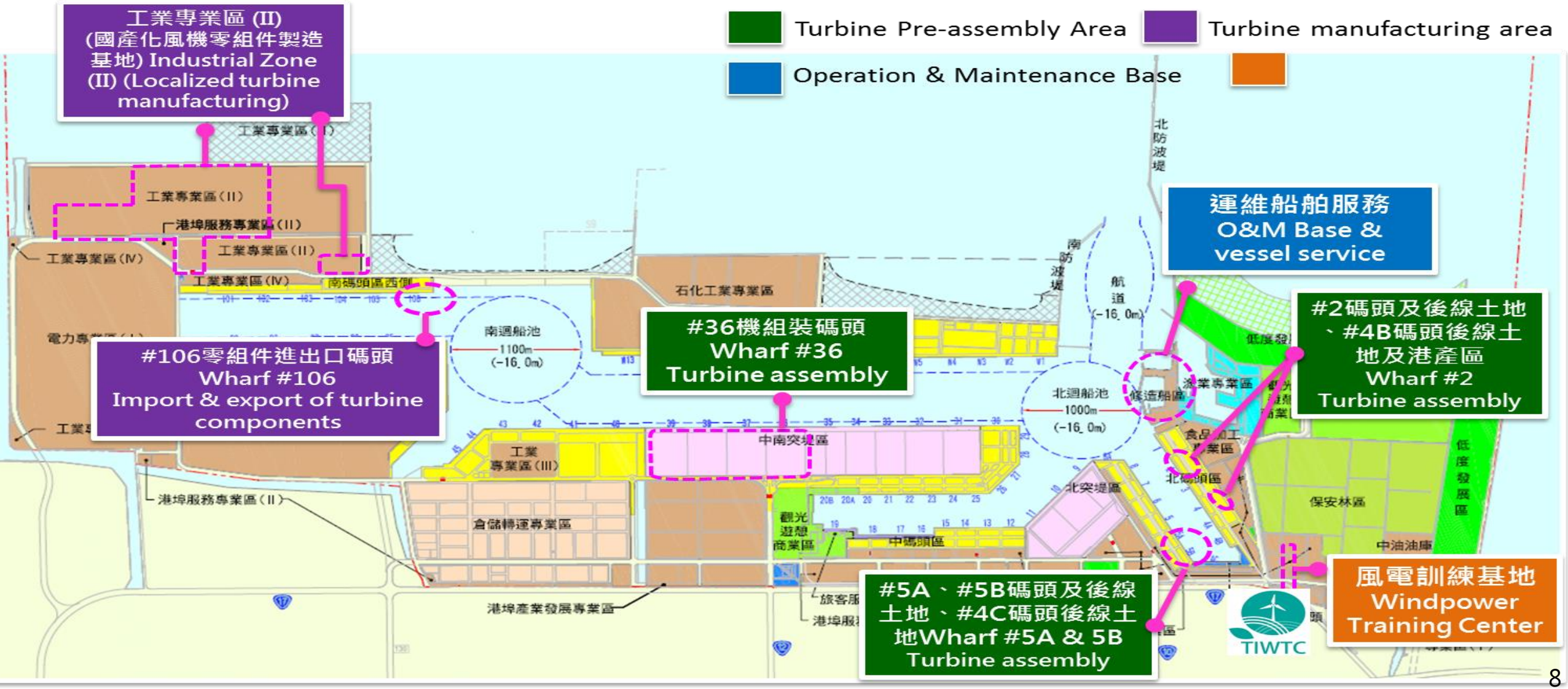
Nowadays

Master Plan


南填方區(II)
南填方區(IV)
工業專業區(II)
港埠服務專業區(II)
工業專業區(II)
南填方區(III)
北填方區(III)
北填方區(I)
南防波堤
北防波堤
工業專業區(IV)
工業專業區(IV)
南碼頭區西側
石化工業專業區
北填方區(II)
航道
(-16, 0m)
漂砂整治區
電力專業區
南碼頭區東側
南迴船池
1100m
(-16, 0m)
西碼頭區
低度發展區(II)
緩衝發展區
北防沙堤
工業專業區(I)
工業專業區(I)
北迴船池
1000m
(-16, 0m)
修造船區
漁業專業區
觀光遊憩商業區
電力專業區(II)
工業專業區(IV)
中南突堤區
工業專業區(III)
食品加工專業區
北碼頭區
北突堤區
港埠服務專業區(II)
倉儲轉運專業區
觀光遊憩商業區
中碼頭區
保安林區
中油油庫專業區
低度發展區(I)
旅客服務中心
港埠服務專業區(II)
森林公園
港埠產業發展專業區
海巡公務碼頭
港埠產業發展專業區
港埠服務專業區(I)

OWP Plan in Taichung Port

臺中港整體規劃圖 Taichung PortMaster Plan



Key Factors for Selecting OWP Port

- Vicinity offshore wind farm
- Quay availability
- Priority regime installation vessel
- Jacking vessels
- Unrestricted access 24/7

Source:DEME

Transportation cost: fuel and time

transportation by land:
The factory to the assembly port、the person to the port
transportation by sea :
Working vessel、CTV、Tugboat、barge

Risk: waves, wind, current, ship crash, insurance

- Ship overturning, sinking
- Time delay
- Equipment damage
- Shorten hours
- Power generation efficiency reduced
- Increased cost by labor and equipment idle
- Port restrictions

Geographical Advantage
74% Windfarms are in vicinity of Taichung Port

Selected 3,836 MW

7developers, 10 windfarms

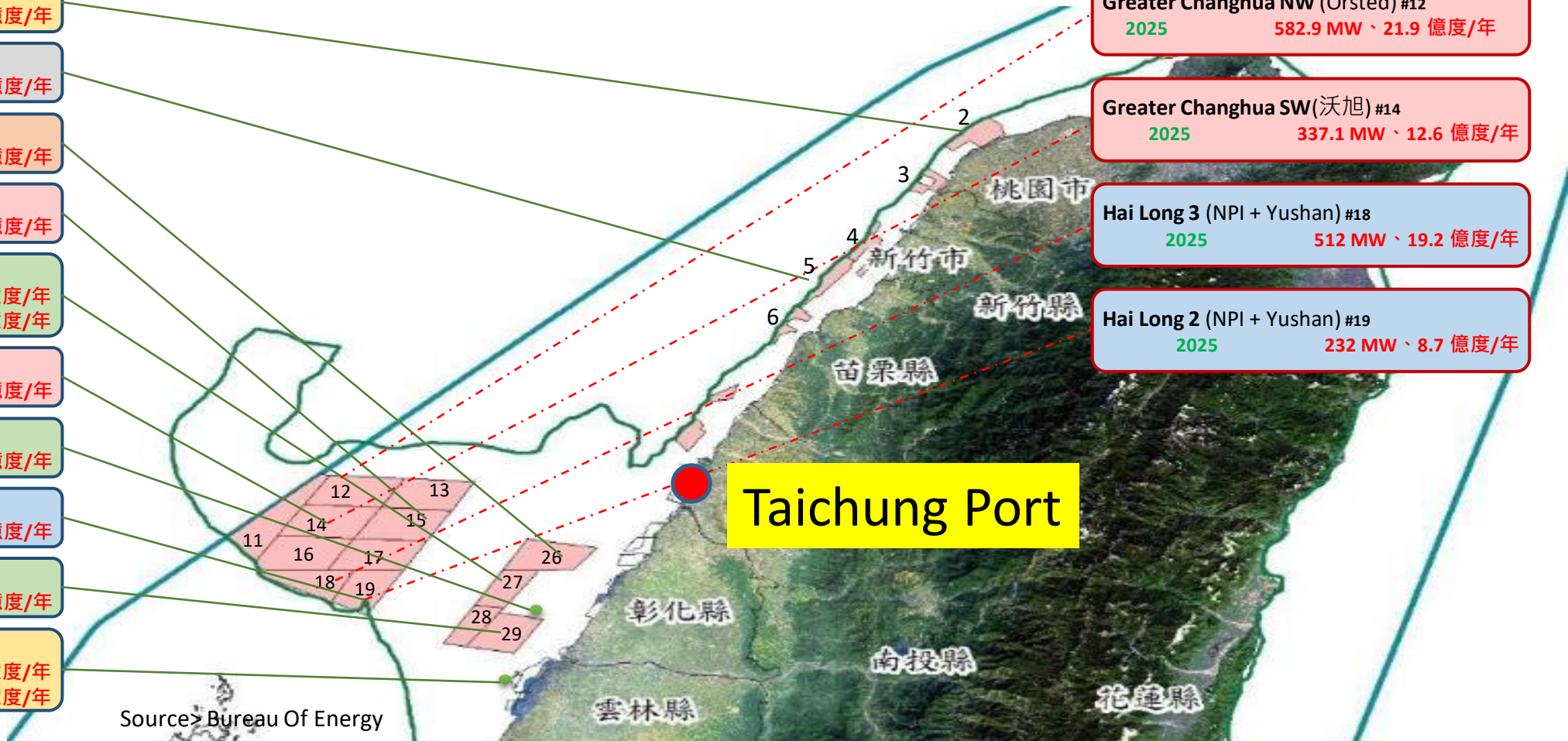
- **Guanyin** (WPD) #2
  2021 — 350 MW、13.1 億度/年
- **Formosa2** (Swancor + Macquarie) #5-6
  2020 — 378 MW、14.2 億度/年
- **TPC** #26
  2024 — 300 MW、11.3 億度/年
- **Greater Changhua SE**(Orsted) #15
  2021 — 605.2 MW、22.7 億度/年
- **Chang Fang** (CIP) #27
  2021 — 100 MW、3.8 億度/年
  2023 — 452 MW、17 億度/年
- **Greater Chuanghua SW**(Orsted) #14
  2021 — 294.8 MW、11.1 億度/年
- **Xidao** (CIP)
  2024 — 48 MW、1.8 億度/年
- **Hai Long 2** (NPI + Yushan) #19
  2024 — 300 MW、11.3 億度/年
- **Jhong Neng** (CSC) #29
  2024 — 300 MW 、11.3 億度/年
- **Yunlin** (WPD)
  2020 — 360 MW、13.5 億度/年
  2021 — 348 MW、13.1 億度/年

Distance to Windfarms :
25-30 Nautical Miles

Auction 1,664 MW

2 developers, 4 windfarms

- **Greater Changhua NW** (Orsted) #12
  2025 — 582.9 MW、21.9 億度/年
- **Greater Changhua SW**(沃旭) #14
  2025 — 337.1 MW、12.6 億度/年
- **Hai Long 3** (NPI + Yushan) #18
  2025 — 512 MW、19.2 億度/年
- **Hai Long 2** (NPI + Yushan) #19
  2025 — 232 MW、8.7 億度/年



Source> Bureau Of Energy

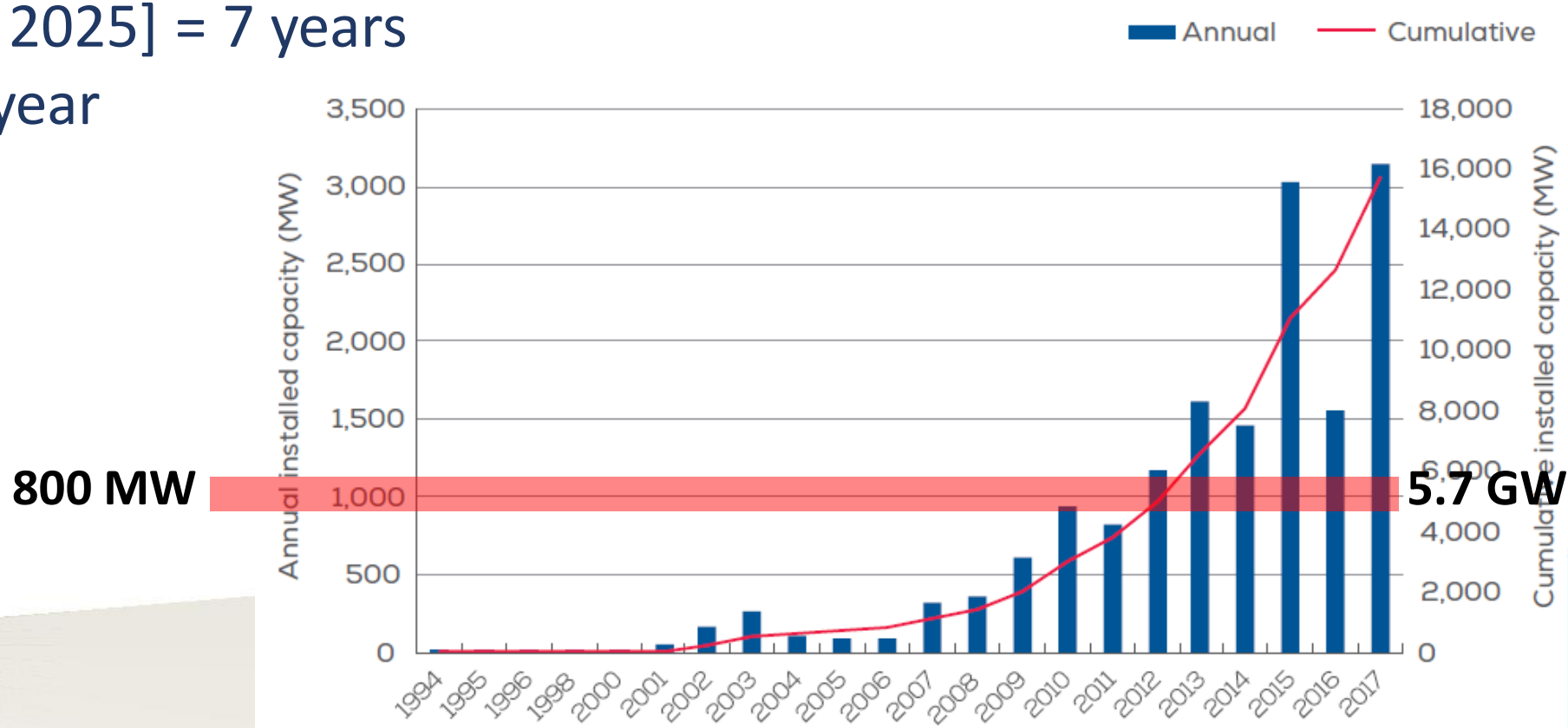
OFFSHORE WIND TARGETS UP TO 2025

Compared to Europe?

⇒ 5.7 GW by 2025

⇒ Period [2019 – 2025] = 7 years

⇒ ~800 MW per year



Main Types of Offshore Wind Port

1

Turbine Manufacturing

2

Foundation Manufacturing

3

Substation Manufacturing

4

Marshaling Port

5

O&M Port

TIPC OWP Plan

Turbine Pre-assembly Area

Taichung Port

- Four wharfs for Turbine Pre-assembly Area
- Home port for working vessels
- Stevedoring, warehousing, transportation & logistics services

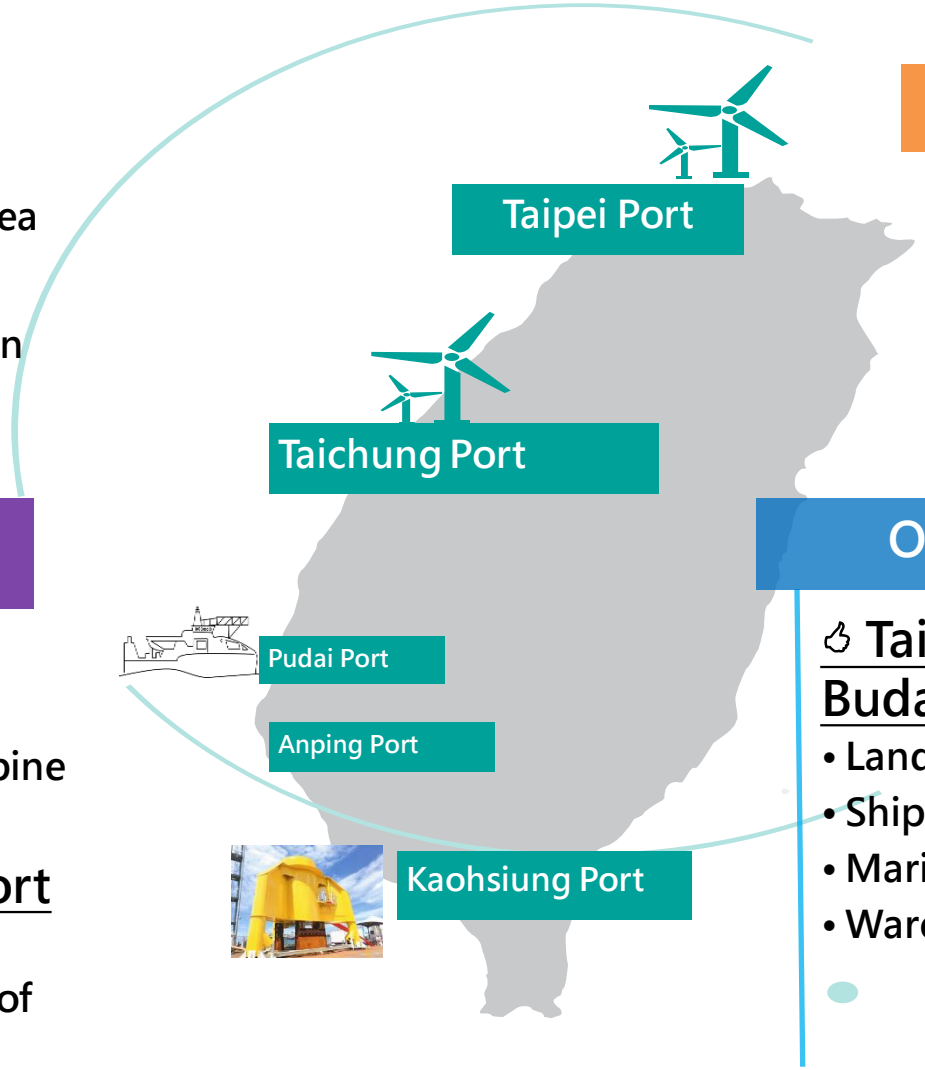
Localized Manufacturing Area

Taichung Port

- Turbine Manufacturing Area
- Wharf #106 Import & export of turbine components

Taipei Port & Kaohsiung Port

- Foundation Manufacturing Area
- Wharf #S09, #111 Import & export of Foundation



Training Center

Taichung Port

Set up an OWP training center to provide GWO and customized courses

O&M Service

Taipei Port, Taichung Port & Budai Port

- Land-based & water-based O&M base
- Ship repairing works
- Maritime transport services
- Warehousing & logistics services

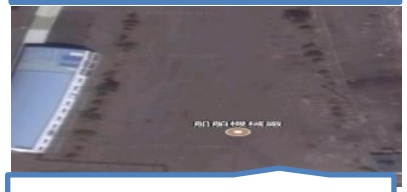
O&M Base in Taichung Port

Marine Coordination Center


Office


Warehouse


Monitoring Office


Yard


Ship Repairment

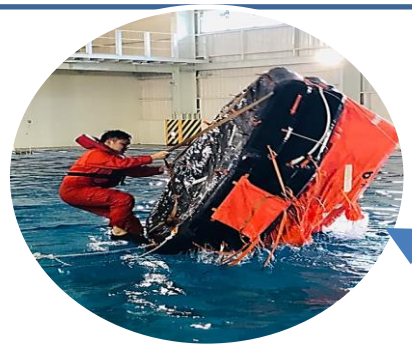

Mobil Crane


Drone


Heliport


CTV

Local Talent Training Center - TIWTC



Basic Safety Training

Sea Survival

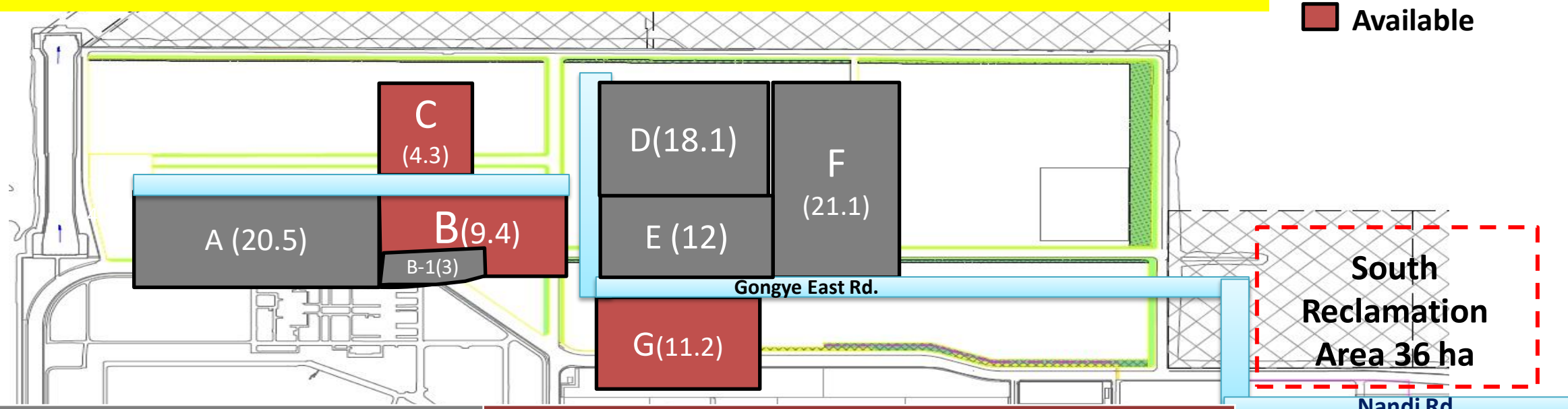
Working at Heights

First Aid

Fire Awareness

Manual Handling

Localized Turbine Manufacturing Area

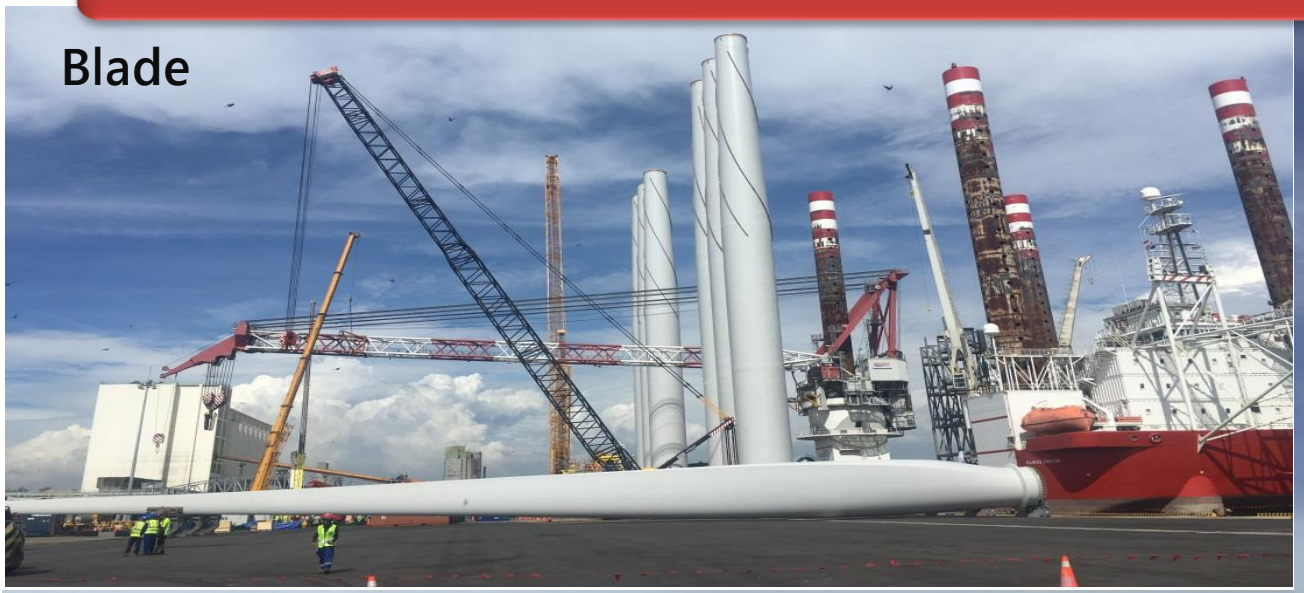


Rented 74.7ha		Available 24.9h	
A:YGG (20.5ha)	Hub	B:9.4ha	Turbine components manufacturing and storage area
B-1:Siemens Gamesa (3ha)	Nacelle	C:4.3ha	
D+E: Century Huaxin (30.1ha)	Tower/Pinpile	G:11.2ha	
F:Tien Li (21.1ha)	Blade		

Case Study-FOW I (Pre-assembly at Quay#2)

Formosa I：Taiwan‘s First Demonstration Wind Farm Project

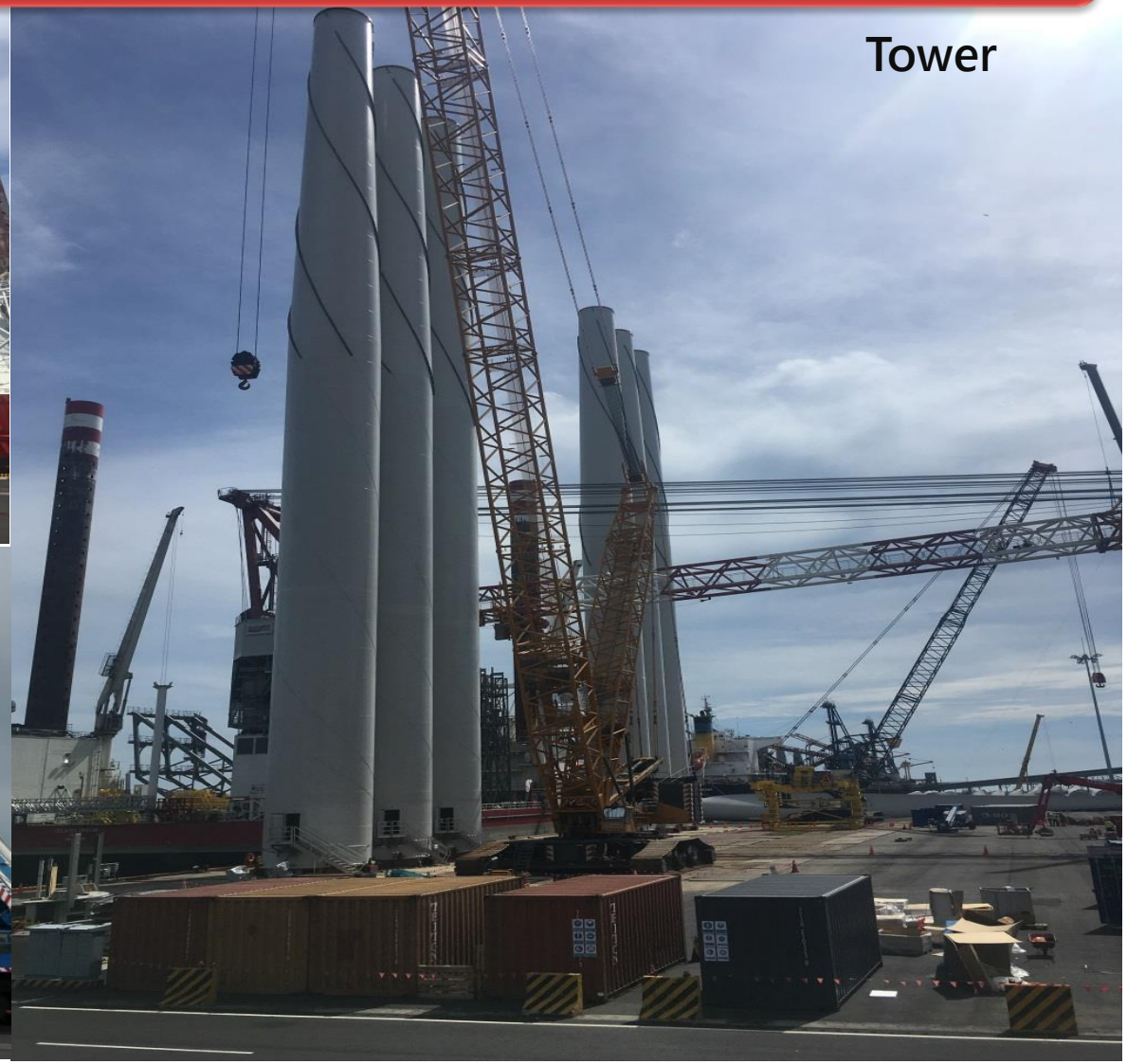
Blade



Nacelle

Taichung port quay#2

Tower



Case Study-FOW I (Foundation Storage at Quay#43)

Formosa I：Taiwan‘s First Demonstration Wind Farm Project

Monopile

採船艉艉靠方式卸貨

卸貨進入儲區

Taichung Port quay #43

Case Study-FOW I (Vessel called at Taichung Port)

Heavy Lifted Vessel

TIV

Cable Laying

CTV

Case Study-FOW I (Vessel called at Taichung Port)

Offshore wind installation and O&M vessels-Size

階段	範例照片	船型	船長 (m)	船寬 (m)	吃水 (m)	船席長 (m)	備　註
施工階段	 Example of Foundation Installation Vessel	下部基礎安裝船 (Foundation Installation)	147.5	42.0	7.3	184	台北港&興達港
	 WTG Installation Vessel	上部風機安裝船 (WTG Installation)	132.0	39.0	6.0	165	台中港
	 Example of Cable Installation Vessel	電纜安裝船 (Cable Installation)	99.0	30.0	4.8	124	台中港&安平港、高雄港兼供
	 Rock installation Vessel	拋石船 (Rock Placement)	167.0	26.0	10.5	209	台中港
施工&運維階段		人員運輸船 (Crew Transfer)	26.0	9.8	2.0	39	台中港&彰化漁港
		服務作業船 (Service Operation)	83.7	17.6	6.5	105	台中港&彰化漁港

註1：船機尺寸依” 大彰化離岸風力發電計畫可行性研究、TIPC新訂船型、ESVAGT

註2：依” Port design’ s handbook” 建議，船席取1.25倍船長；小型船泊渠長度取1.5倍船長計

Case Study-FOW I (Vessel called at Taichung Port)

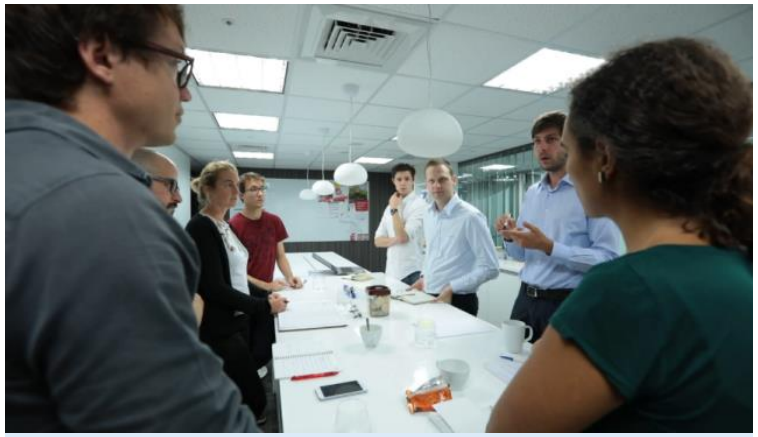
工作項目		進出港艘次	載運船名	出發港-目的地
Foundation	水下基礎單樁式 M/P	進港/load-in (4艘次，一艘10支MP，每次在港作業6天)	ZHI XIAN ZHI XING	德國Rostock-臺中港
			Sun Shine	德國Rostock-臺中港
	轉接段 T/P	進港/load-in (6艘，一艘8支TP，每次在港作業3天)	Kinetic	泰國-臺中港
	水下基礎單樁式 M/P	出港/load-out (20趟，每趟1套水下基礎+13個水泥漿貨櫃，每次在港作業時間1~2天，往返風場2天)	Yudin	臺中港-風場
	FDN Bubble Curtain Vessel	8艘次	Pacific Liberty	臺中港-風場
	Anchor Handling Tug	8艘次	Pacific Warlock	臺中港-風場
		8艘次	Pacific Valkyrie	臺中港-風場
Turbine	葉片&機艙 Blade & Nacelle	進港/load-in (10艘次，每次在港作業約6天)	HAPPY RANGER	丹麥Aalborg
			Regine	德國Cuxhaven-丹麥Aalborg-臺中港
			Prinsengracht	德國Cuxhaven-丹麥Aalborg-臺中港
			Anne-Sofie	德國Cuxhaven-丹麥Aalborg-臺中港
			Trina	德國Cuxhaven-丹麥Aalborg-臺中港
	塔架Tower	進港/load-in (10艘次，每次在港作業約3~4天)	Paula	越南PhuMy-臺中港
	整套風機	出港/load-out (10趟，每趟2架風機，在港作業期間約5~6天，往返風場約5天)	Zaratan	臺中港-風場

Case Study-FOW I (Vessel called at Taichung Port)

工作項目		進出港艘次	載運船名	出發港-目的地
Sea cable	Cable Laying Vessel	14艘次	Willem De Vlamingh	臺中港-風場
	Cable Pulling/T+T Support Vessel	4艘次	Posh Dauntless	臺中港-風場
	Cable Dredger Vessel	8艘次	Offshore Solution	臺中港-風場
CTV	人員運輸支援船(統計期間108/06*108/11)	118艘次	Cwind Phantom	臺中港-風場
		78艘次	World sea	臺中港-風場
		108艘次	World sail	臺中港-風場
	人員運輸支援船(統計期間108/05*108/07)	86艘次	臺港22601	臺中港-風場

- Installation period of FOWI Started from Q1, 2019 to the final turbine installation in Q4, 2019. The port calling of marine engineering vessels and SOVs, CTVs are about 530 voyages.
- 海洋風場自108年第1季開始施工安裝風機，於108年第4季完成最後一架風機安裝，在此期間，海事工程及人員運補船約530艘次自臺中港進、出港。

Challenges in Offshore Wind



Interface management.

- Fast-track project, Delivered in short period of time
- Management of multiple subcontractors, suppliers and stakeholders
- Navigational Safety
- Emergency Rescue

Regulatory framework.

- Modification in applicable port dues including stevedoring and berthing charges
- Taiwanese flagging
- Taiwanese classification
- Taiwanese crewing
- Importation process

Port infrastructure.

- Time consuming to enhance heavy-loaded quays and hinterlands
- Limited berthing windows
- Efforts made to accommodate large scale projects

Challenges in Offshore Wind

Postponement

- Covid-19 Impact-Technician and Seafares Quaranteen
- Local communities and Fishermen Protest
- Force Majeure and Excusable Events

Port Logistics

- Long Transportation Route and Obstacles to tackle
- O&M warehouses
- Spare Cable Storage Base

Policy

- How far can it go?
- Labor training / education
- Bigger turbine size
- Floating turbine option

Thank you very much for your attention