Current Status of Taiwan Offshore Wind Energy Policy and Development

Thousand Wind Turbines Project

Wu-Chi Ho / Deputy General Director

Green Energy and Environment Research Laboratories
Industrial Technology Research Institute

Overview

- New Energy Policy of Taiwan
- Wind Resource in Taiwan
- Promotion Targets & Strategies
- Domestic Industry
- Challenges & Cooperation

New Energy Policy of Taiwan

2011.11.03	New Energy Policy announced: to "Steadily Reduce Nuclear Dependency, Gradually Move Towards a Nuclear-free Homeland, and Create a Low-carbon Green Energy Environment"
2010.05	Approval of the "National Master Plan on Energy Conservation and Emission Reduction"
2010.01	Establishment of the "Committee on Energy Conservation and Emission Reduction"
2009.07.08	"Renewable Energy Development Act" Amendment of "Energy Management Law"
2009.04.15-16	The 3rd "National Energy Conference"
2008.06.05	"Framework of Sustainable Energy Policy"

Renewable Energy Target in 2030

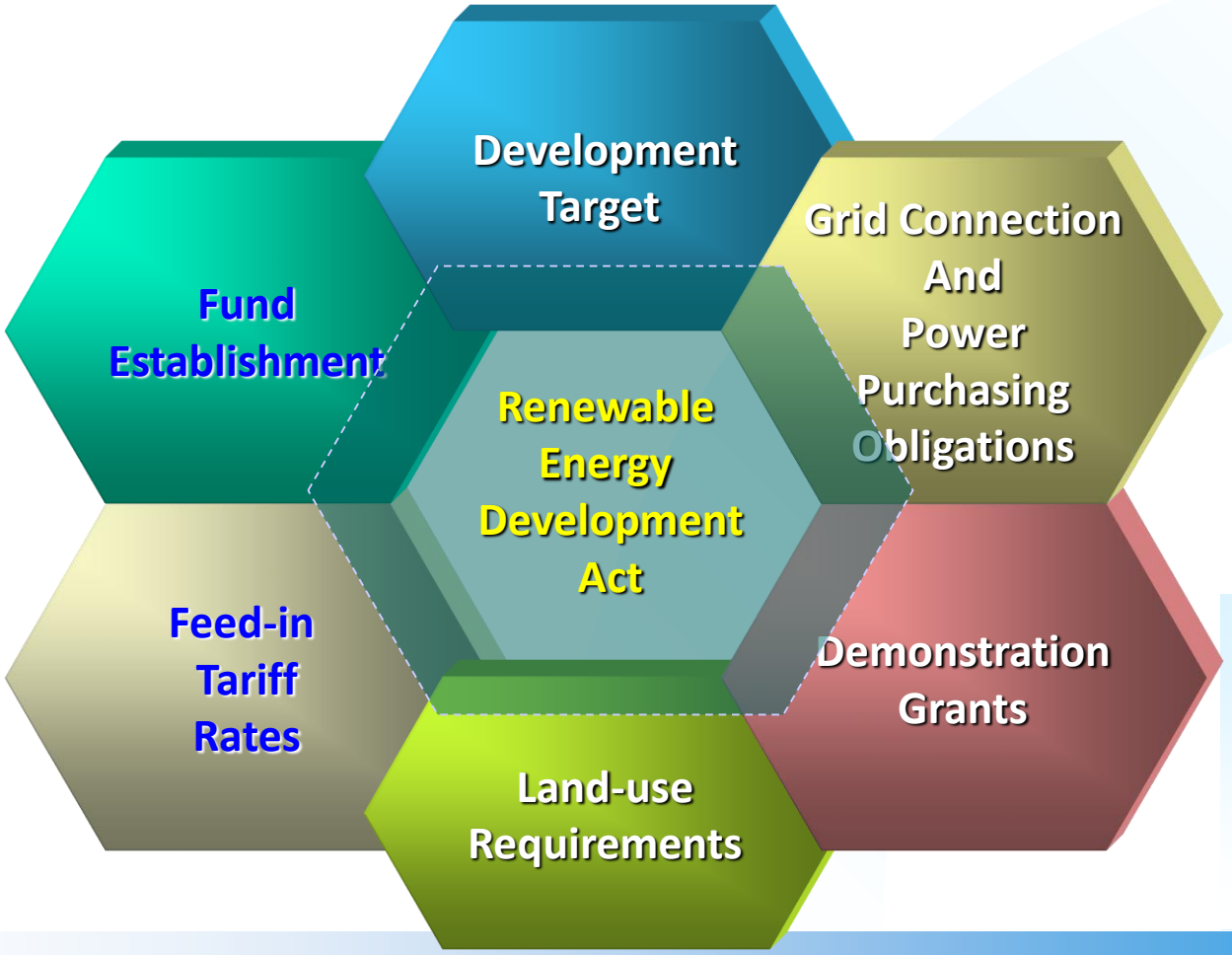
- The installed capacity of renewable energy was **4,319 MW** by the end of 2015.
- Targeted renewable power generation capacity is **17.25 GW** by 2030.
  - ➔ *Almost tripled compared to 2014 level*
- Renewable energy development in Taiwan is toward increasing renewable energy supply and raising renewable energy target to achieve **20%** renewable electricity generation by **2025**.

Energy Source \ Years		Power Capacity (MW)						Electricity Generation (TWh)					
		2009	2014	2015	2020	2025	2030	2009	2014	2015	2020	2025	2030
Solar PV		10	620	842	3,615	6,200	8,700	0.01	0.6	0.9	4.5	7.8	10.9
Wind	On-shore	374	637	647	1,200	1,200	1,200	0.8	1.5	1.5	2.9	2.9	2.9
	Off-shore	0	0	0	520	2,000	4,000	0	0	0	1.8	6.8	13.6
Hydro Power		1,937	2,081	2,089	2,100	2,150	2,200	3.7	4.3	4.5	4.7	4.8	4.9
Biomass		739	740	740	768	813	950	3.4	3.5	3.6	5.6	5.9	6.9
Geothermal		0	0	0	100	150	200	0	0	0	0.6	1.0	1.3
Total		3,060	**4,079**	**4,319**	**8,303**	**12,513**	**17,250**	7.9	9.9	10.5	20.1	29.2	40.5

Ref. Bureau of Energy, Ministry of Economic Affairs, TAIWAN

Renewable Energy Development Act

- In order to systematically promote renewable energy, government promulgated the ***Renewable Energy Development Act*** in July 2009.



Feed-in Tariff System

Renewable Energy Development Act (REDA, 再生能源發展條例)

- **The core strategy of the Act is Feed-in Tariff system.**
- **PPA** (power purchase agreement) **of renewable energy is guaranteed for 20 years.**
- **A Committee is formed to review the formula and tariffs annually.**
- **Tariffs shall not be lower than the average cost of domestic fossil-fueled power.**

Feed-in Tariffs of wind power in Taiwan:

- **Onshore:** NT$2.8099 (€7.6¢) / kWh for 20 years
- **Offshore:**
  - **Option #1:** NT$5.7405 (€15.6¢) / kWh for 20 years
  - **Option #2:** NT$7.1085 (€19.3¢) / kWh for the first 10 years
    NT$3.4586 (€9.4¢) / kWh for the next 10 years

Topics

- Taiwan's New Energy Policy
- **Wind Resource in Taiwan**
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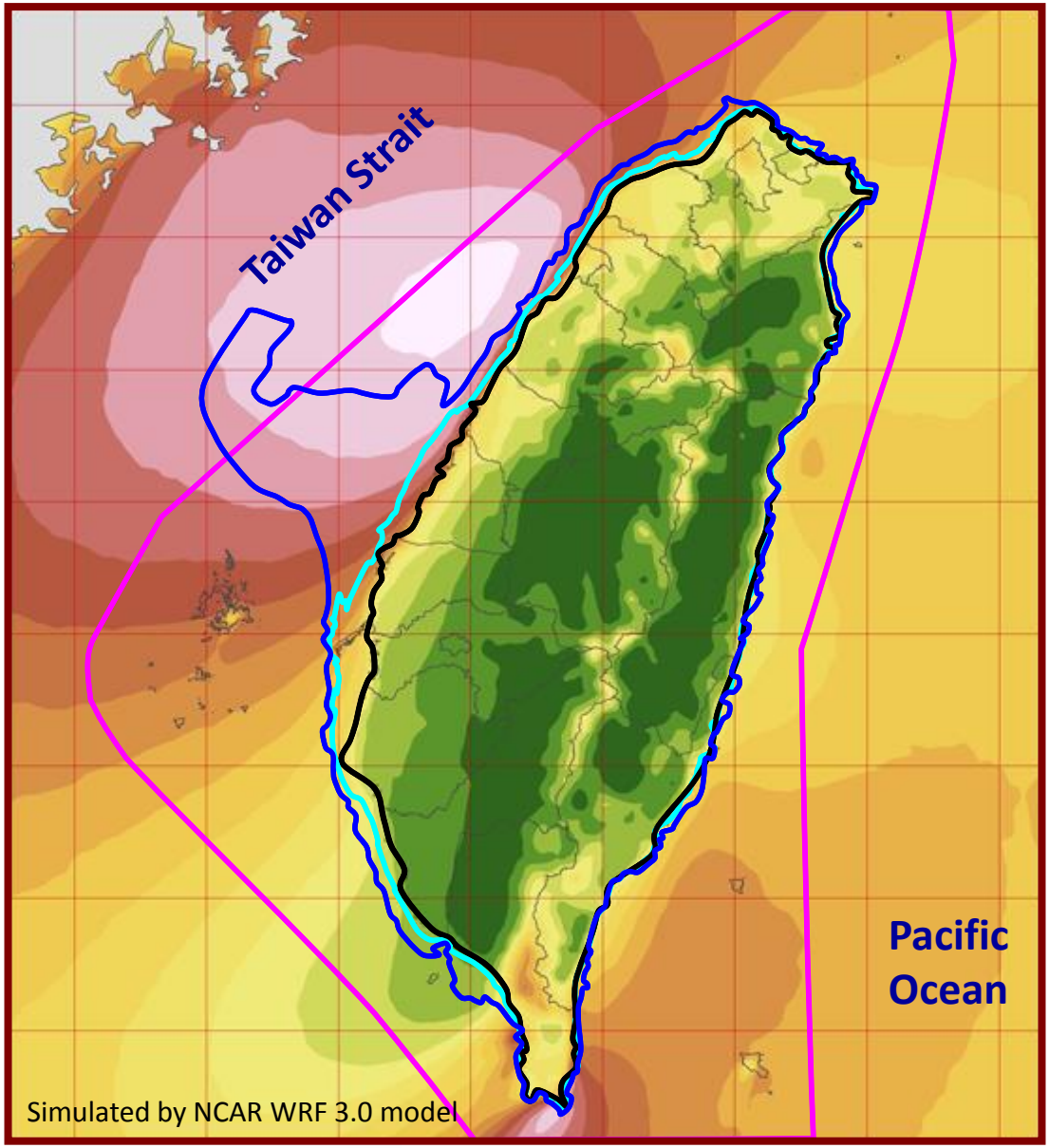
Taiwan Offshore Wind Potential

- **Shallow Water** (5-20 m)
  - **Area:** 1,779.2 km^2
  - **Potential:** 9 GW
  - **Feasible:** 1.2 GW
- **Deep Water** (20-50 m)
  - **Area:** 6,547 km^2
  - **Potential:** 48 GW
  - **Feasible:** 5 GW
- **Deeper Water** (> 50 m)
  - **Potential:** 90 GW
  - **Feasible:** 9 GW



Wind Power Density(W/m2)

< 100	400 - 500	800 - 900	1,200 - 1,300
100 - 200	500 - 600	900 - 1,000	1,300 - 1,400
200 - 300	600 - 700	1,000 - 1,100	1,400 - 1,500
300 - 400	700 - 800	1,100 - 1,200	> 1,500

Ref. "Wind Resource Assessment Handbook," ITRI, 2011

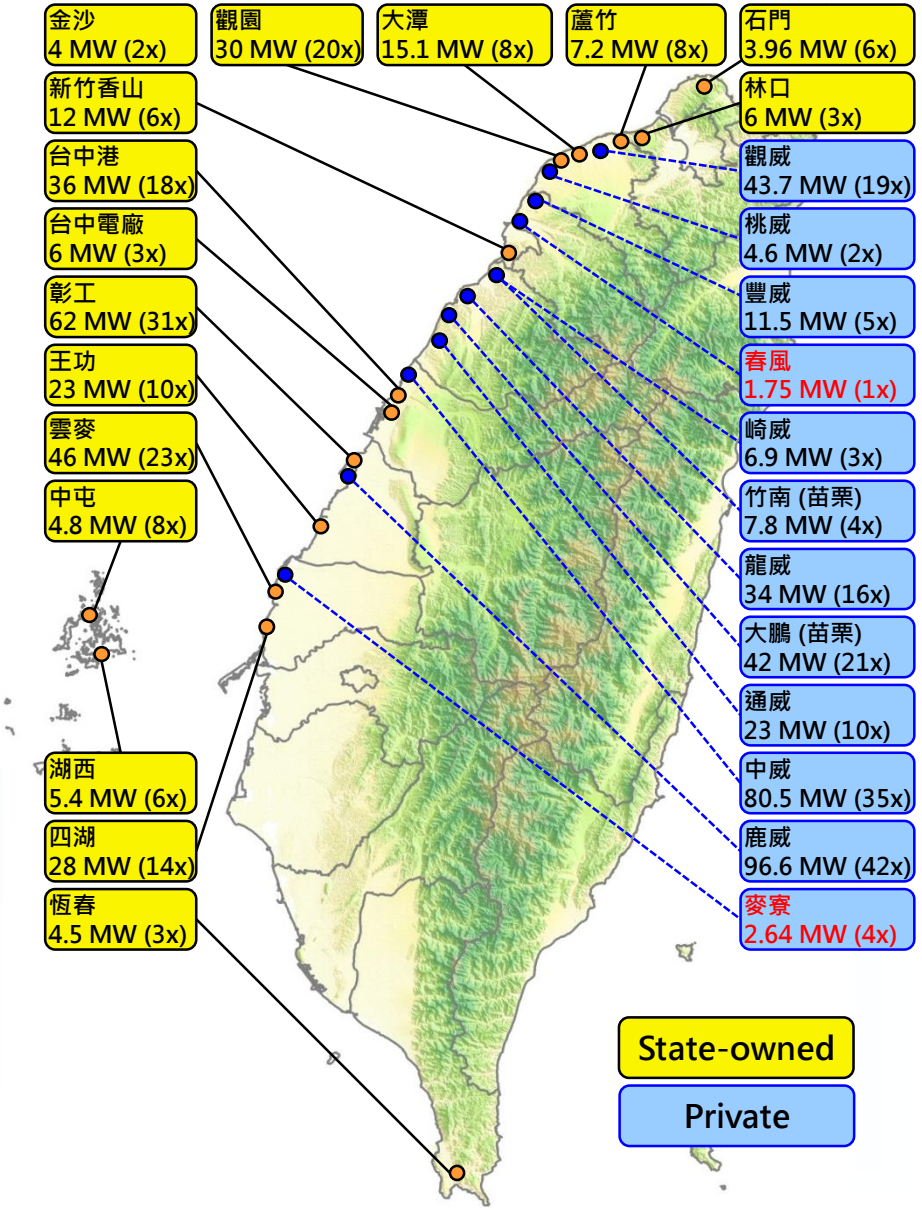
Current Status of Wind Development

Onshore (by the end of Mar 2016)

- **State-owned:** 169 WTs / 294 MW
- **Private:** 162 WTs / 355 MW
- **Total:** 331 WTs / 649 MW (14.7 % of all RE)
- **2015 Production:** ≈ 1,517 GWh (14.5 % of all RE)

Offshore

- **No offshore wind turbine has been installed yet.**



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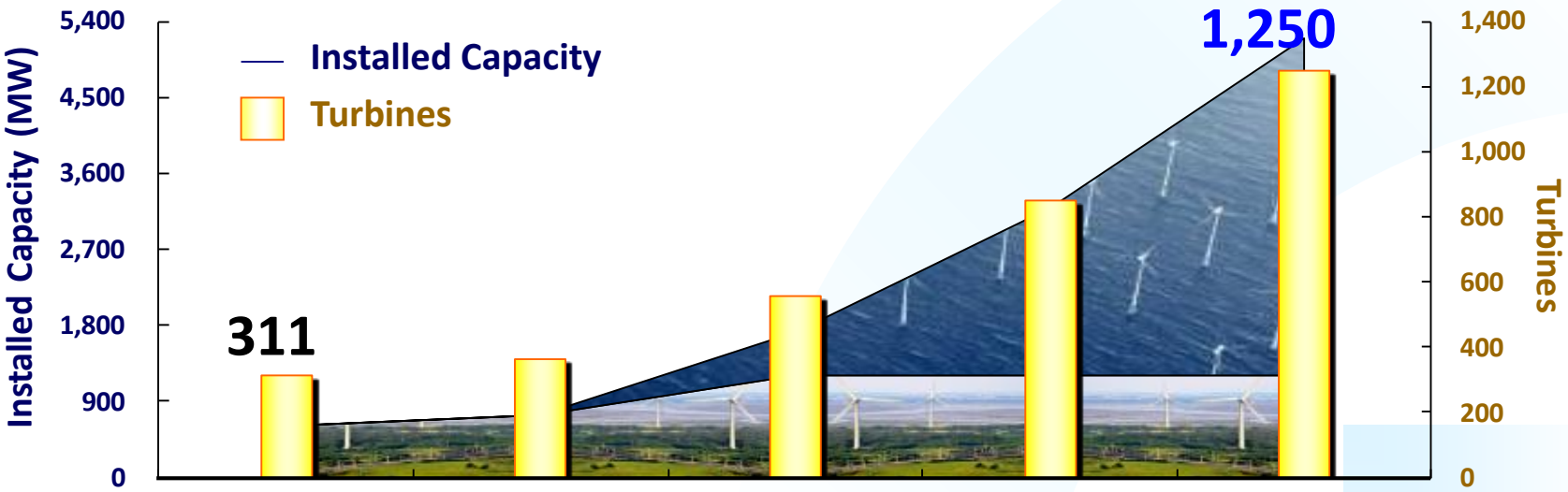
Targets of Wind Power Development

Thousand Wind Turbines Project (千架海陸風力機計畫)

- **Short-term Target:** 4 demonstration offshore wind turbines by 2016
- **Mid-term Target:** Offshore 520 MW by 2020
- **Long-term Target:** Offshore 3,000 MW by 2025, 4,000 MW by 2030



Year	2013		2015	2020	2025	2030	
	MW	WTs	MW	MW	MW	MW	WTs
Onshore	614	311	647	1,200	1,200	1,200	450
Offshore	0	0	0	520	3,000	4,000	800
Total	614	311	647	1,720	4,200	5,200	1,250

Ref. Bureau of Energy, Ministry of Economic Affairs, TAIWAN

Strategies for Offshore Wind

DIP Incentives for Pioneers → **ZAP** Transition Period → **ZD** Self-sustaining Industry

[Phase 1] Offshore Demonstration Incentive Program (示範獎勵辦法)

- 4 Demonstration Turbines by 2016, 3 Demonstration Wind Farms by 2020
- Government provides subsidy for both equipment & developing processes

[Phase 2] Directions of Zone Application for Planning (場址申請作業要點)

- 36 Zones of Potential revealed for preparation in advance of Zonal Development
- Applicants must acquire EIA approval by 2017 and Preparation Permit by 2019

[Phase 3] Offshore Zonal Development (區塊開發)

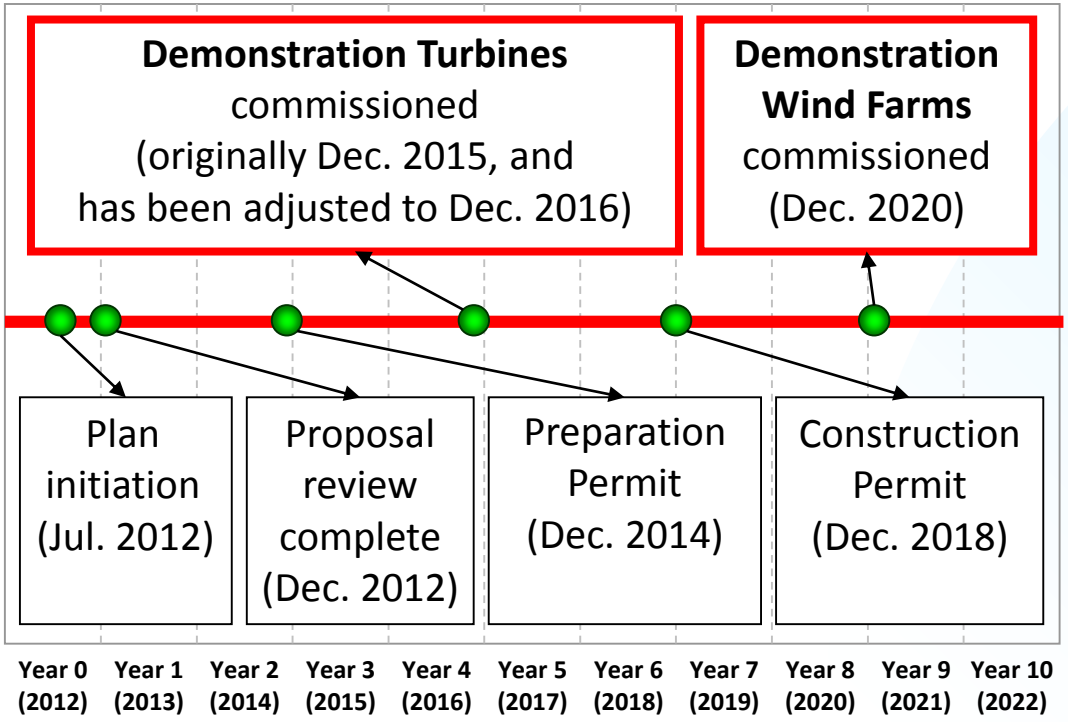
- To be announced by 2017 while SEA is currently in progress
- Commercial scale for cost reduction (similar to Round 3 of UK)

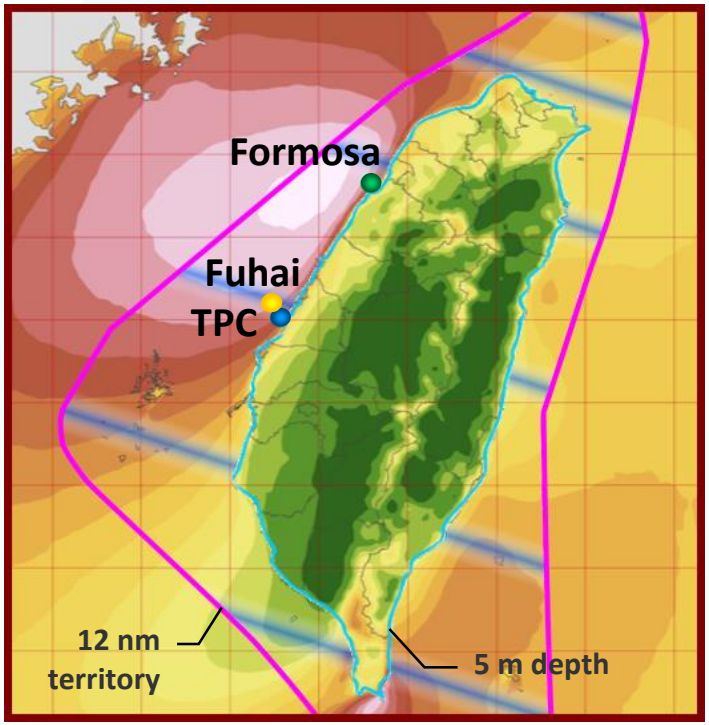
Demonstration Incentive Program

[Phase 1] DIP

Demonstration Projects of Offshore Wind

- 3 Winners (Fuhai, Formosa & TPC) officially announced on 9th January 2013
- MOEA provides subsidies for both turbines & wind farms to encourage pioneers
- To confirm feasibility in terms of administration, technology and finance





Specifications & Requirement of DIP

[Phase 1] DIP

- **Met Mast** (海氣象觀測塔)
  - **Water depth:** 10 m or more
  - **Height:** 70 m or more
- **Demonstration Turbines** (示範機組)
  - **Capacity:** at least 3 MW each
  - **Commissioned by 2016**
- **Demonstration Wind Farm** (示範風場)
  - **Water depth:** 5 m or more
  - **Capacity:** 100-200 MW each
  - **Commissioned by 2020**

Awarded Demonstration Projects

[Phase 1] DIP

Formosa (海洋) @Miaoli

- **Capacity:** 128 MW (32 turbines)
- **Distance from Shore:** 2-6 km
- **Water Depth:** 15-35 m

Fuhai (福海) @Changhua

- **Capacity:** 120 MW (30 turbines)
- **Distance from Shore:** 8-12 km
- **Water Depth:** 20-45 m

TPC (台電) @Changhua

- **Capacity:** 108-110 MW (18-30 turbines)
- **Distance from Shore:** 7-9 km
- **Water Depth:** 15-25 m

Zone Application for Planning

Siting for Zones of Potential (ZoP, 潛力場址)

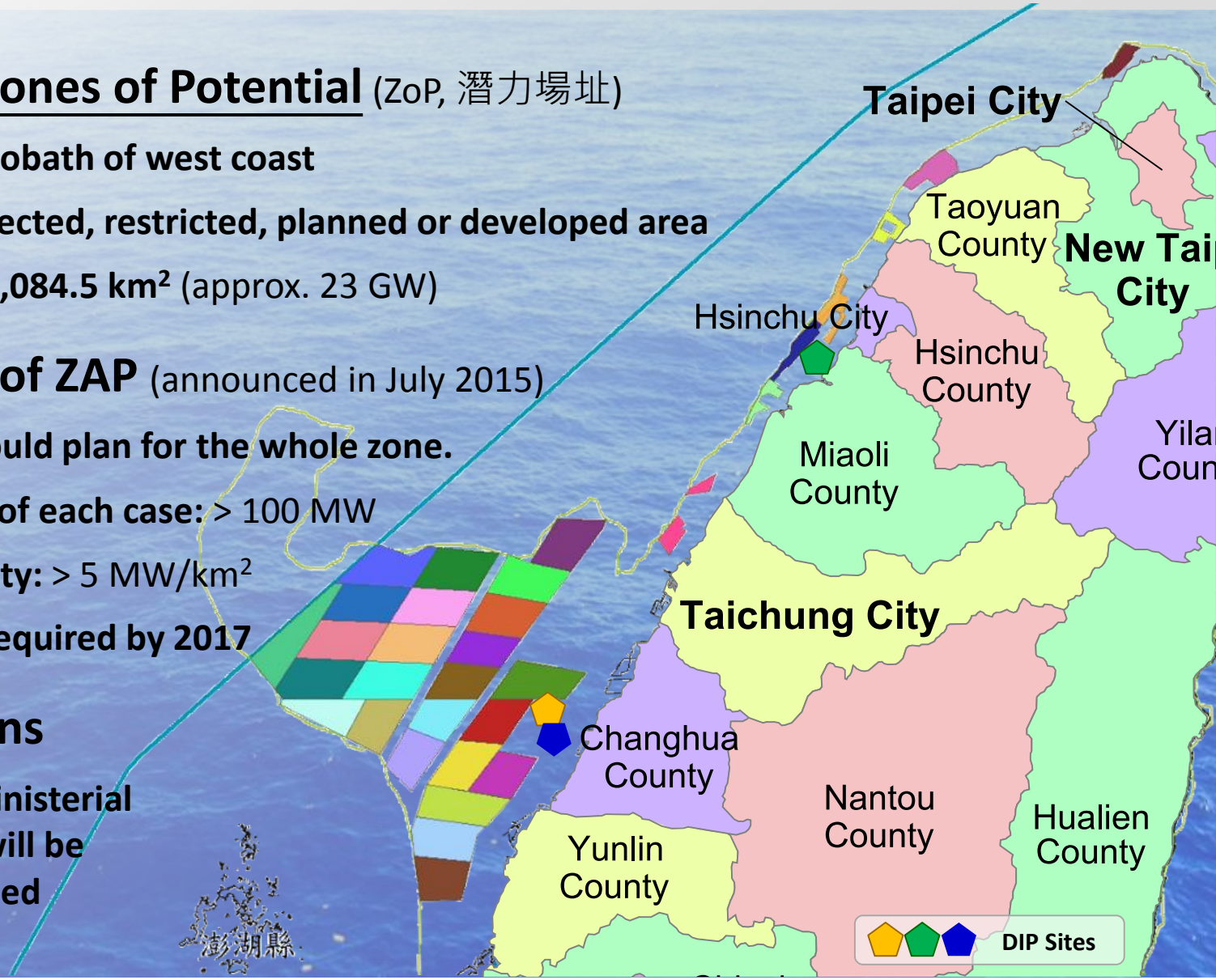
- **Within 50 m isobath of west coast**
- **Excluding protected, restricted, planned or developed area**
- **36 ZoP: total 3,084.5 km² (approx. 23 GW)**

Directions of ZAP (announced in July 2015)

- **Applicants should plan for the whole zone.**
- **Total capacity of each case:** > 100 MW
- **Capacity density:** > 5 MW/km²
- **EIA approval required by 2017**

Negotiations

- **SEA & inter-ministerial negotiations will be conducted based on 36 ZoP.**



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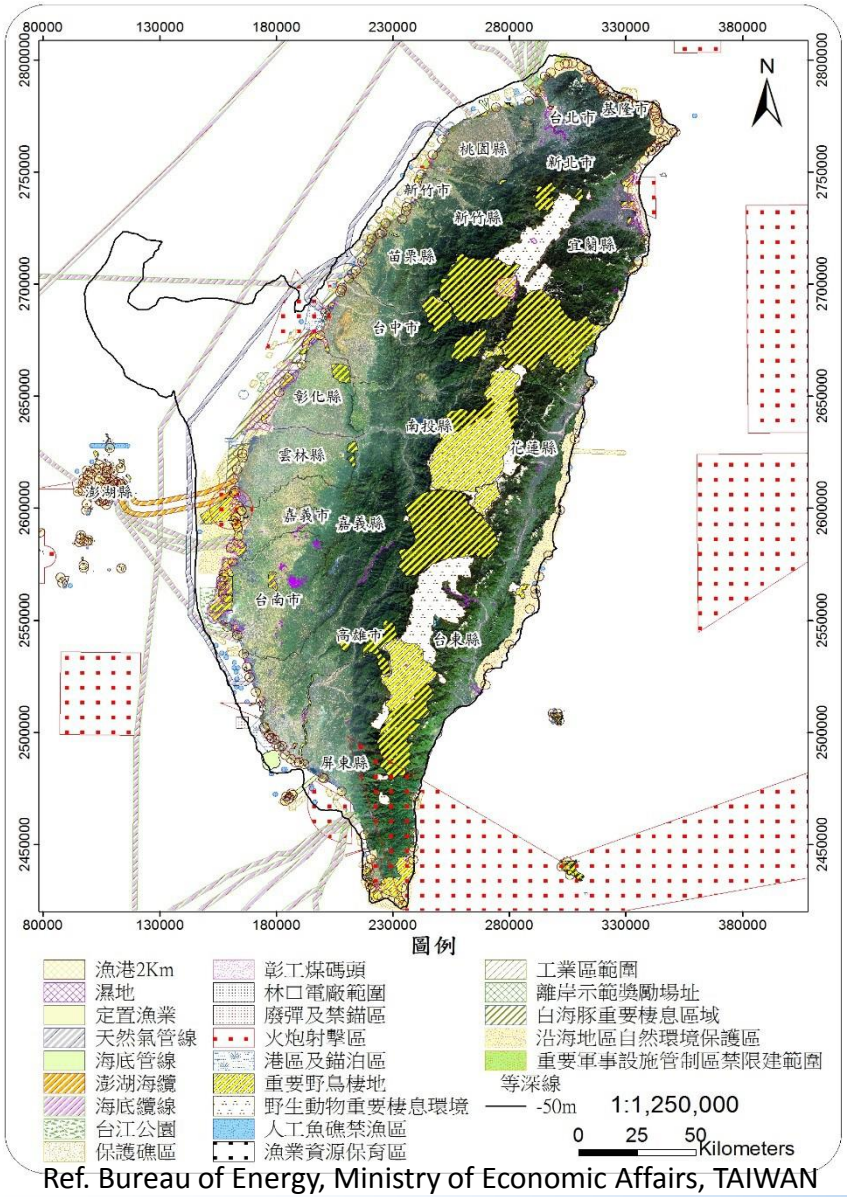
Zonal Development



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- **To be announced by 2017**
- **Zones will be released in stages**
  - **500 MW-2 GW for each stage**
- **To reach 3 GW target by 2025**

* More detail will be discussed in the Group Two:

『Policy for Zonal Development of the Offshore Wind Farm』

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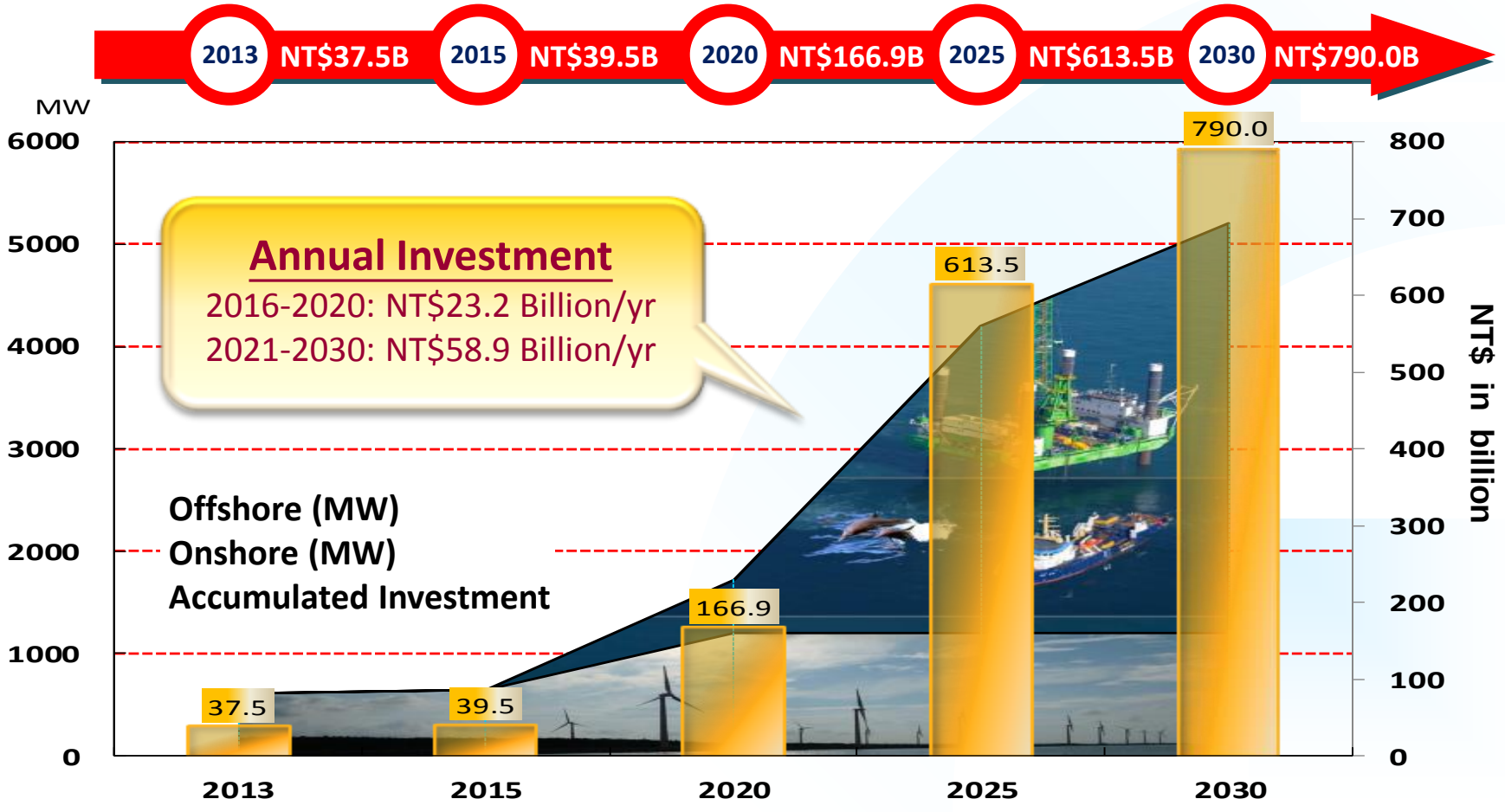
Domestic Market Estimates

- **Offshore 3,000 MW by 2025 → NT$540B** (€14B) **investment**
- **Policy → Developers → Service Providers → Manufacturers**



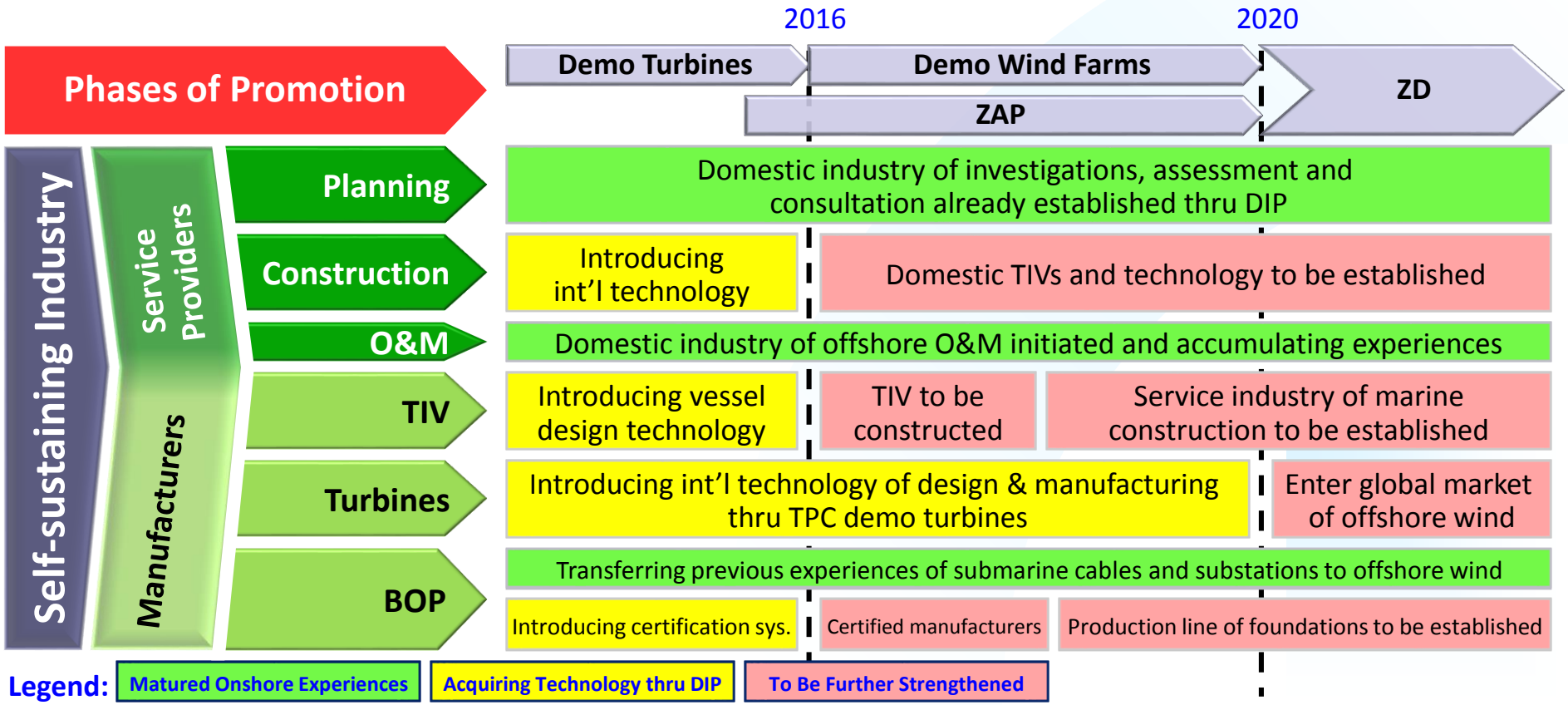
Supply Chain of Wind Power in Taiwan

Manufacturing | **Service** | **Developer**

Supply Chain	Raw Material	Components/ Sub-system	System	Balance of Plant (BoP)	Planning	Construction	Maintenance	Operation
Core Business	Steel、Fiber、Epoxy	Electrical Sys.、Gearbox、Blade、Control、Tower、Cast/Forge		Foundation、Cable、Substation				
Foreign Firms	LM(DK) ABB(CH) Winergy(DE) Hansen(US)	LM(DK) ABB(CH) Winergy(DE) Hansen(US)	Siemens(DE) MHI Vestas(DK) Senvion(DE) Adwen(FR) Alstom(FR) GE(US)	Bladt(DK) ABB(CH) Winergy(DE) MBG(DE) Pihl-Züblin(DE)	Dong Energy(DK) EDP(ES) E.ON(DE) RWE(DE) DNV.GL(NO)	A2SEA(DK) MPI(UK) Van Oord(NL) Workfox(NL) Fudada(JP) Daiichi(JP)	Dong Energy(DK) EDP(ES) E.ON(DE) RWE(DE)	Dong Energy(DK) EDP(ES) E.ON(DE) RWE(DE)
Local Firms	Epoxy: Swancor Steel: CSC	Tower: CSMC Cast: YGG Gearbox: FHI Blade: Horizon Yachts Control: TECO transformer: DELTA Connector: SinBon	New Wind Power (TECO & CSC)	CSC CSBC CIAS TAYA	CECI Sinotech	CSC CSBC Hung Hua Hwa Chi Woen Jinn	CSC CSBC	Fuhai Swancor TPC CSC
Current Condition	**Steel: superiority in local market Epoxy: supply goods for Siemens**	**Dominated by foreign turbine manufactures**	**Threats from foreign turbine manufactures eg. Siemens**	**Capable of met mast, but lack actual experience in offshore wind farm**	**Need to collaborate with foreign consultant**	**Capable of nearshore engineering, but lack actual experience in offshore wind sector**	**Need to collaborate with foreign firms**	**lack actual experience in offshore wind farm**

Self-sustaining Industry of Offshore Wind

- Identify the missing puzzles thru DIP
- Match international experts with domestic players
- Develop full-spectrum capabilities



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Major Challenges

Asian Environment

- Turbine design resistant to typhoons
- Foundation design resistant to earthquakes

Environmental Impact

- Migrating birds & marine mammals
- Local fishery, navigation safety, and harbor development

Infrastructure & Supporting Measures

- Quays, harbor, and offshore wind industrial park
- Consenting processes & inter-department negotiation

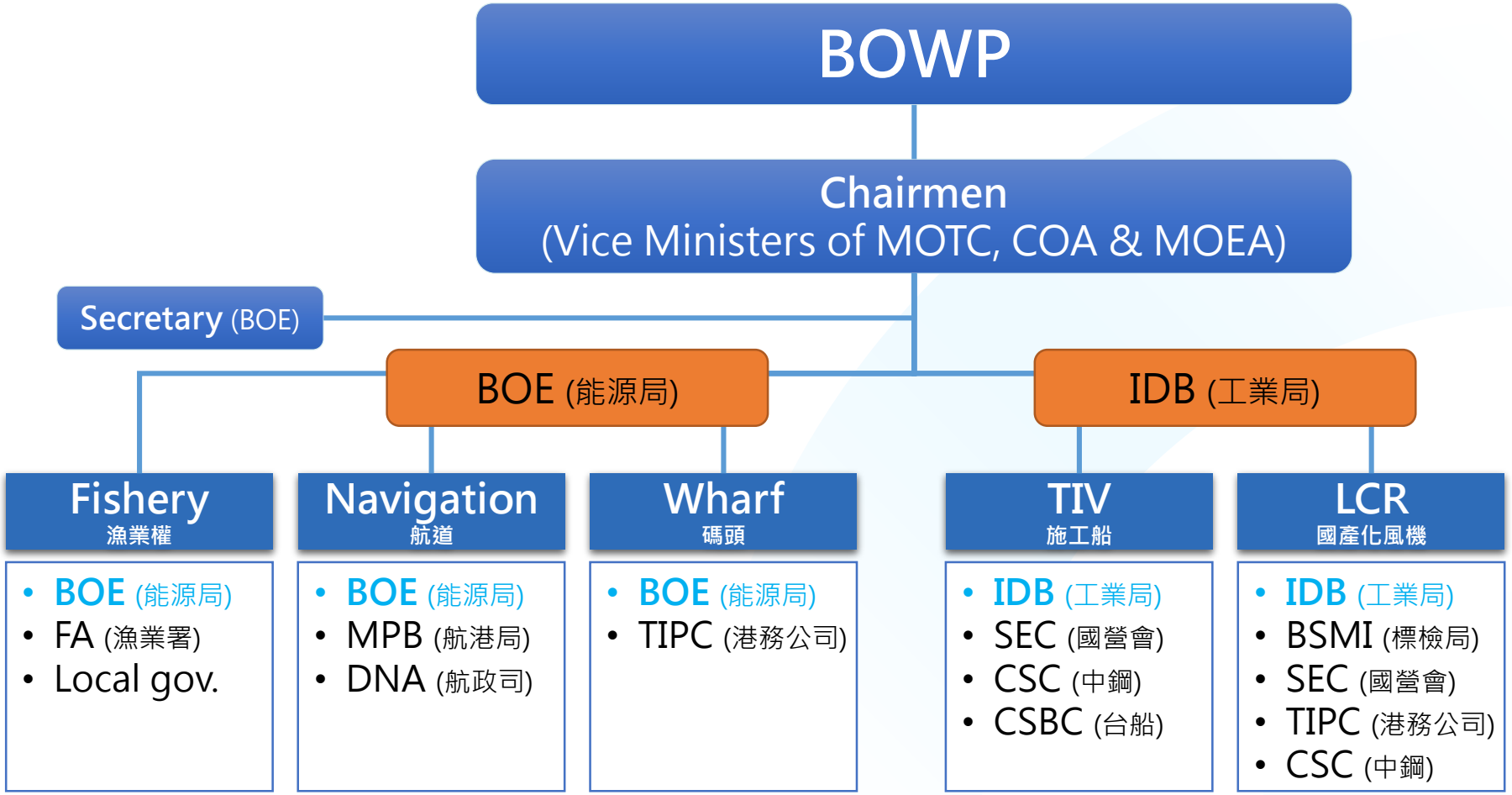
Marine Construction

- Contract strategies & project management
- Vessel coordination & risk management

Pictures from: Vergnet, YCPS, bis, Centrica

Inter-ministerial Negotiation

Organization



International Interactions of Offshore Wind

Successful Experiences of Wind Farm Development

- **Strategy:** demonstration project vs commercial scale
- **EIA solutions:** navigation, fishery, environmental activists
- **Infrastructure:** design of onshore base for offshore wind farm industry
- **Finance & insurance:** project finance and risk management

Taiwan Offshore Demonstration Wind Farm Project

- **Developers:** general consulting, project management and financial advice
- **Service Providers:** marine construction and O&M
- **Manufacturers:** typhoon-proof design technology

Thanks for Your Attention

Thousand Wind Turbines Promotion Office

http://www.twtpo.org.tw